

SYSTEMATICS OF THE SOUTHERN AFRICAN GENUS *GEISSORHIZA* (IRIDACEAE—IXIOIDEAE)¹

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ABSTRACT

Geissorhiza is a large genus of small, corm bearing perennials endemic in the Cape Province of South Africa and is restricted to the winter rainfall area of the south and west coasts and immediate interior. The genus is defined by its asymmetric corms with hard, often woody tunics, herbaceous bracts, and long style with short recurved branches. It is separated by style morphology from the closely related *Hesperantha*, in which the style is included in the perianth tube and the style branches are long and spreading, and, in addition, the anthers of *Hesperantha* are introrse at anthesis. Eighty-one species are recognized in this study, 29 described here for the first time. This represents an increase of some 25 over the 52 species of true *Geissorhiza* admitted by Foster (1941) in his revision of the genus and the eight species placed by Lewis (1941) in *Engysiphon*, a genus here reduced to synonymy. A novel subgeneric classification is proposed in which two subgenera, *Geissorhiza* (34 spp.) and *Weihea* (47 spp.) are recognized, each including several sections. *Geissorhiza* is seen as a late Tertiary genus that probably differentiated in upland southeastern Africa when much of southern Africa including the Cape Region was still heavily forested. The continuing deterioration of the climate in the Pliocene and Pleistocene that culminated in the establishment of a Mediterranean climate in the southwestern Cape probably gave the impetus to the extensive radiation in the mountains and western coastal belt in this area, where most species, including all of the more specialized taxa, occur. Primitive taxa are concentrated along the relatively well-watered southern Cape coast, where little speciation has occurred and the primitive taxa appear to have differentiated slowly by a process of phyletic evolution. The geography of *Geissorhiza* is analyzed in detail and several important centers of endemism, corresponding closely with Weimarck's phytogeographical subdivisions are identified. The major trends in the evolution of *Geissorhiza* include: the development of imbricate corm tunics from the basic concentric type; the reduction or extreme elongation of the perianth tube; the development of floral zygomorphy; and the elaboration of the leaf lamina, which may become several ribbed and grooved (section *Geissorhiza*), or may have raised and winged ciliate margins and a winged midrib (section *Ciliata*) or thickened margins and midrib (especially sections *Angustifolia* and *Ixiopsis*). Cytological studies have brought the number of species in which the chromosome number is known to 41, over half the genus. Basic chromosome number is $x = 13$, and while most species are diploid, polyploidy has been recorded in a few species including the triploid vegetative apomict, *G. bolusii*. The conservation status of *Geissorhiza* is reviewed and several seriously threatened species are identified including almost all those endemic to the coastal plain between Cape Town and Piketberg, an intensively farmed area rich in species.

Geissorhiza is a large genus of medium to small, corm bearing plants, restricted entirely to the winter rainfall region of the south and west coasts of southern Africa. It is centered in the mountains and western coastal belt of the southwestern Cape, with species extending as far east as Grahamstown in the eastern Cape and as far north as Steinkopf in northern Namaqualand. *Geis-*

sorhiza is a member of Ixioidae, a predominantly African subfamily, strongly developed in southern Africa, and is distinguished by its woody to papery (rarely fibrous) corm tunics, asymmetric corms, herbaceous floral bracts, and long, exserted style (included in two species) with short recurved style branches. It is most closely related to *Hesperantha* (ca. 55 spp.—Goldblatt, 1982a,

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1984) from which it differs mainly in its style and style branches. In addition, *Hesperantha* is unusual in the family in having introrse anthers at anthesis.

Since its treatment in "Flora Capensis" (Baker, 1896) in which 29 species were recognized, *Geissorhiza* has been completely revised only by Foster (1941). Foster admitted 55 species to the genus, three subsequently transferred to *Gladiolus*, including the only species he recognized from Madagascar, *G. bojeri* (Goldblatt, 1982b). A second Madagascan species *Geissorhiza ambongensis*, which he regarded as "doubtful or unknown," is here also excluded from *Geissorhiza* but its correct generic position is uncertain. Despite having been revised relatively recently, *Geissorhiza* has, for reasons outlined below, been poorly understood. Foster's revision was based on herbarium material only but he did not examine the important collections in South African herbaria, and was thus unaware of several undescribed species in these collections. The revision was also in part unnatural, combining unrelated taxa in some subsections, and the key was difficult to use. In addition, extensive collecting in South Africa, especially in recent years, has resulted in the discovery of many species that were clearly undescribed. A few of these are local lowland endemics but most are montane species of middle and upper elevations, many discovered only in the last 40 years, as the Cape mountain flora was systematically explored, largely by the Cape botanist, Elsie Esterhuysen.

Eighty-one species in two subgenera and 12 sections are recognized in this treatment (Table 1), in which *Engysiphon* Lewis (8 spp.) is reduced to sectional rank. Some 12 species admitted by Foster are reduced to synonymy, two to subspecies status, while two of Foster's varieties are raised to specific rank, and 29 species are described here for the first time. The subgeneric classification followed here is novel, being based primarily on the characteristics of the corm rather than the leaf which were considered of more fundamental importance by Foster. Both corm and leaf structure vary to an unusual extent in *Geissorhiza* and these aspects are examined in detail in this study. Chromosome cytology, also investigated here, is relatively uniform with $x =$

13 the basic chromosome number. Most of the 40 species known cytologically are diploid, but *G. bolusii* is an apomictic triploid, and three species are tetraploid, or have tetraploid races.

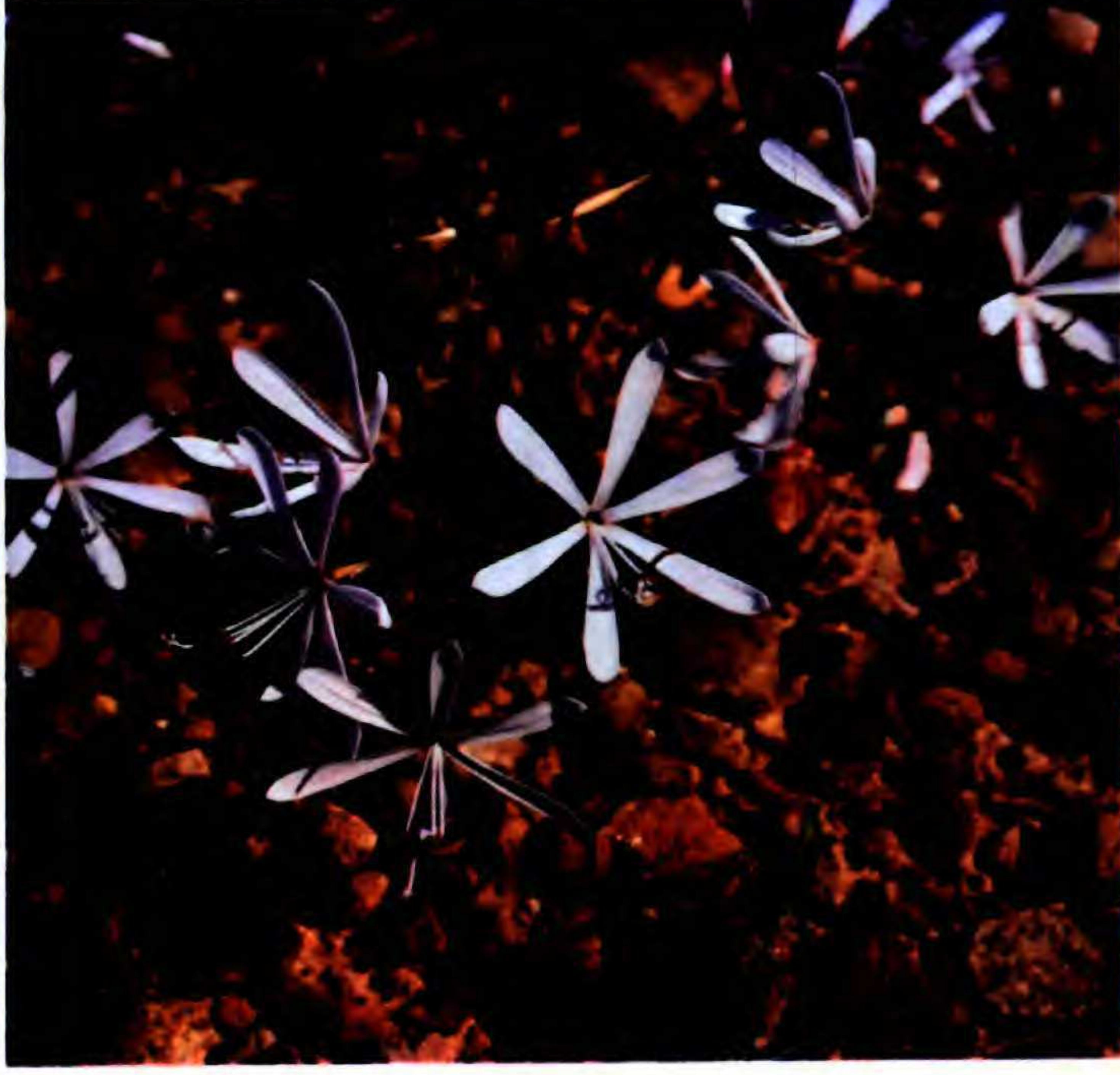
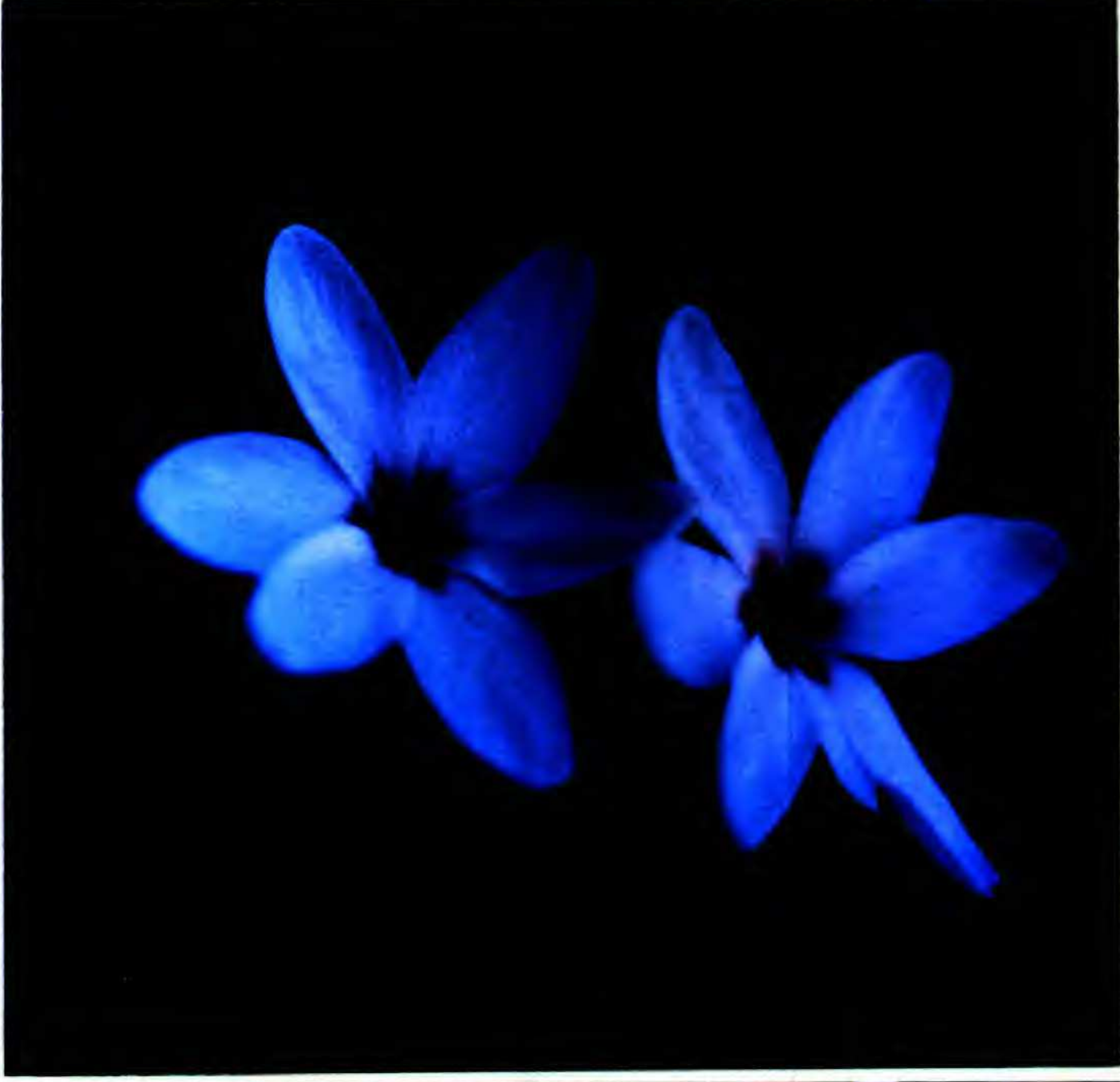
RELATIONSHIPS AND SYSTEMATIC POSITION OF *GEISSORHIZA*

Geissorhiza is a member of the largely African subfamily Ixioideae, an alliance defined by a spicate inflorescence, the sessile flowers of which are subtended by a pair of opposed bracts. The tepals are always united in a tube which is often well developed, and the rootstock is a basally rooting corm that typically has a stele (De Vos, 1977).

It is reasonably well established on morphological and cytological grounds (Lewis, 1954; Goldblatt, 1971, 1982a, 1984) that *Geissorhiza* is most closely related to *Hesperantha*, a widespread African genus of some 55 species, also centered in the southern African winter rainfall region. The apparently primitive species of both genera have identical asymmetric corms with light brown, firm to woody, concentric tunics, herbaceous floral bracts, small actinomorphic flowers, and membranous capsules with numerous turbinate to angular seeds. Unspecialized species of both genera can in fact only be distinguished by their different style and style branches and anther dehiscence in the actinomorphic flowered species. In *Geissorhiza*, the long style is well-exserted from the perianth tube and divides towards the apex of the anthers into three short recurved branches (near the base of the anthers in three species and the style included in two more). *Hesperantha* differs in having a relatively short style, typically dividing in the throat of the perianth tube into three long laxly spreading branches. The anthers of *Hesperantha* are introrse at anthesis, contrary to the normal condition for species of Iridaceae with actinomorphic flowers.

The two genera share a common basic chromosome number, $x = 13$, a number unusual in Iridaceae, but also found in the related *Schizostylis* (mono- or di-typic) and in some species of the apparently unrelated *Romulea* (De Vos, 1972). Lewis (1954) placed *Geissorhiza* in a sub-

FIGURES 1-6. From left to right and top to bottom.—1. *Geissorhiza elsiae*.—2. *G. corrugata*.—3. *G. karooica*.—4. *G. cedarmontana*.—5. *G. nubigena*.—6. *G. longifolia*.



tribe Ixiinae close to *Hesperantha* in a lineage that also includes *Gladiolus* and the small, highly specialized genera such as *Homoglossum* and *Anomalesia*, closely allied to *Gladiolus*. In a more refined classification (Goldblatt, 1971), *Geissorhiza* is placed together with *Hesperantha*, *Schizostylis*, and the monotypic *Melasphaerula* in Hesperanthinae, a classification that still seems to best reflect the relationships of these genera. *Melasphaerula* ($x = 11$) is probably isolated in the alliance, if it correctly belongs here, but it has the woody corm tunics that define the subtribe.

The difference between *Geissorhiza* and *Hesperantha* appears to be based on relatively minor features but nevertheless, they appear on phenetic grounds to comprise monophyletic assemblages. The patterns of variation are coherent in both genera and are consistent with the contention that they are indeed natural groups, even though *Geissorhiza* can at present only be defined negatively, with respect to *Hesperantha*, by a combination of unspecialized characteristics.

The unspecialized species of *Hesperantha* have pale, white or pink flowers and are usually evening blooming and strongly sweet scented. The genus is believed to be a basically moth pollinated group but day blooming species with colored flowers are probably bee pollinated (Vogel, 1954; Goldblatt, 1984). In contrast, the species of *Geissorhiza* are always day blooming and typically scentless, and the genus is believed to be largely bee pollinated (Vogel, 1954).

MORPHOLOGY OF *GEISSORHIZA*

Species of *Geissorhiza* are small, geophytic corm bearing perennials. Actual age is difficult to determine but plants with up to 12 annually produced corm tunic layers are known. With the exception of *G. outeniquensis*, species grow actively in the wet seasons of the year, usually winter and spring (or summer at higher altitudes), flower in spring or summer, and become dormant during the dry, later spring or summer and autumn. *Geissorhiza outeniquensis* is apparently evergreen and has a very reduced underground storage organ. It grows in permanently moist montane habitats and appears to have no dor-

mant period during the year. *Geissorhiza fourcadei* flowers in the autumn but it is restricted to sites that remain moist throughout the summer or all year.

All parts of the plant body have some specialized features and these are discussed in the following pages, under the main headings of corm, leaves, stem, inflorescence, flower, stamens, gynoecium, and fruit.

CORM

The corm of *Geissorhiza* consists of a swollen internode with an apical bud, typically covered with hard, woody to firm and papery tunics. The live portion of the corm is a white (Fig. 13A–E) asymmetric body, being somewhat flattened on one side or towards the base, and with a peculiar downward oriented projection at the lower end of the flattened side, from which the roots are produced. The corms vary considerably in the genus but fall into two main groups, those with concentric or with imbricate tunics (the terminology of Foster, 1941, 1948).

The basic tunic type is assumed to be one with concentric layers, a type shared with the related genus *Hesperantha*, in which corm and tunic morphology have recently been described in detail (Goldblatt, 1982b). Here the overall shape is often asymmetric (Fig. 13), reflecting the internal structure but the presence of the lateral projection is not always evident externally. Corms with concentric tunics are usually small, of constant size, and the older tunic layers split irregularly from base and apex into somewhat elliptic sections which completely enclose the new tunic layers produced in successive years. The tunics are usually light to middle brown in color.

In the second major corm type in *Geissorhiza*, the outer tunics cover the inner above only, and are thus imbricate. The corm shape is usually nearly symmetric and more or less ovoid with a small flat basal part. The tunics are usually dark brown to blackish, but in *G. similis* and *G. scillaris* they are a light brown color as in species with concentric corm tunics. In either case, the layers are notched below in a regular pattern that gives the corms their very characteristic appearance (Fig. 13F–K). The upward displacement of

FIGURE 7–12. From left to right and top to bottom.—7. *Geissorhiza malmesburiensis*.—8. *G. barkerae*.—9. *G. purpureolutea*.—10. *G. mathewsii*.—11. *G. radians*.—12. *G. splendidissima*.

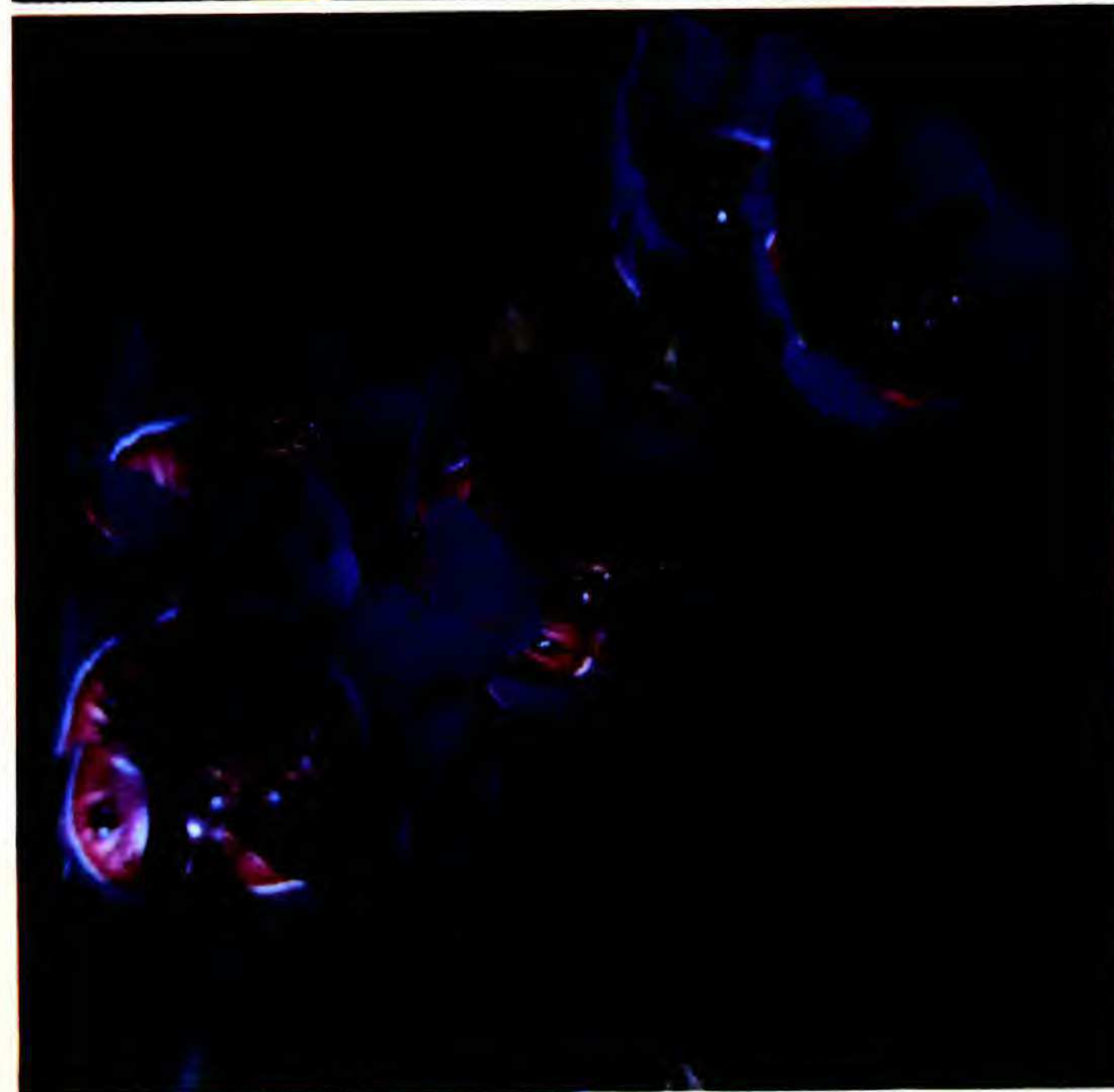
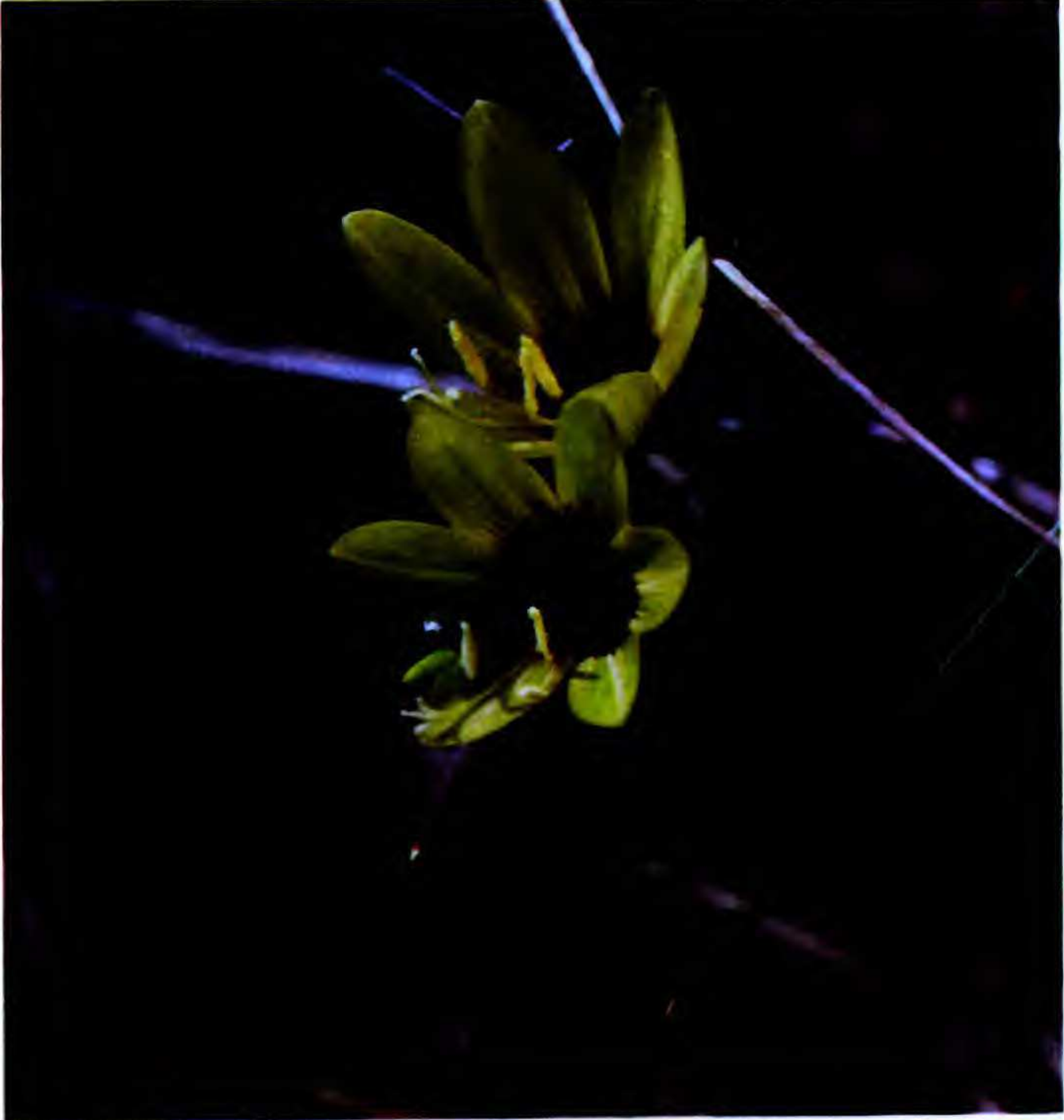
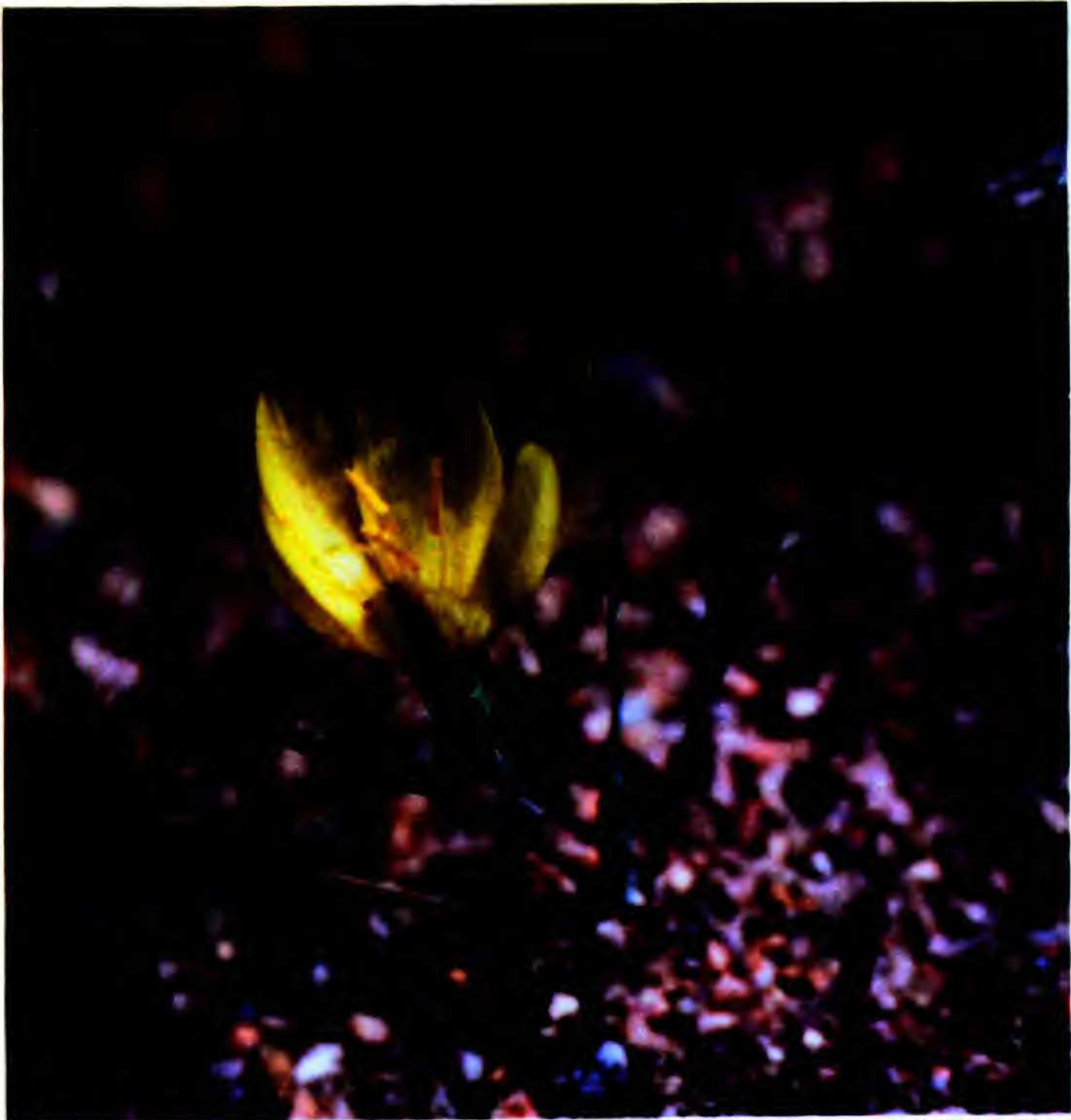


TABLE 1. The species of *Geissorhiza* arranged in systematic order, in their sections. Brief distribution and habitat data are also listed for convenience.

Subgenus <i>Weihea</i> (Baker) Goldbl.	
Section <i>Weihea</i> —18 spp.	
1. <i>G. inconspicua</i> Baker	S Cape between Swellendam and Uitenhage
2. <i>G. elsiae</i> Goldbl.	Kammanassie Mts.
3. <i>G. roseoalba</i> (Lewis) Goldbl.	Little Karoo, Longkloof to Uitenhage
4. <i>G. outeniquensis</i> Goldbl.	wet shady sites, Outeniqua Mts., George district
5. <i>G. fourcadei</i> (L. Bolus) Lewis	Swartberg, Outeniqua and Tsitsikamma Mts., Robinsons Pass to Humansdorp
6. <i>G. foliosa</i> Klatt	slopes flats at the foot of the Langeberg
7. <i>G. nigromontana</i> Goldbl.	Great Swartberg, along streams
8. <i>G. delicatula</i> Goldbl.	mts. of the interior S Cape
9. <i>G. bracteata</i> Klatt	S Cape near Albertinia to E Cape at Grahamstown
10. <i>G. nana</i> Klatt	Caledon district to Riversdale, clay slopes and flats
11. <i>G. setacea</i> (Thunb.) Ker	SW Cape, wet sandy flats
12. <i>G. ornithogaloides</i> Klatt	
subsp. <i>marlothii</i> (Foster) Goldbl.	widespread in the interior Cape region, Cedarberg E to the Long Kloof
subsp. <i>ornithogaloides</i>	Paarl district to Caledon and Bredasdorp
13. <i>G. malmesburiensis</i> Foster	Malmesbury, sandy slopes
14. <i>G. geminata</i> E. Meyer ex Baker	wet sites, interior SW Cape
15. <i>G. ovalifolia</i> Foster	damp sites, SW Cape mts.
16. <i>G. bolusii</i> Baker	damp shady sites, SW and W Cape mts.
17. <i>G. parva</i> Baker	SW and W Cape mts., sandy soils and rocks
18. <i>G. ovata</i> (Burm.f.) Asch. & Graeb.	SW and S Cape, sandy soils, mainly montane
Section <i>Tortuosa</i> Foster—3 spp.	
19. <i>G. corrugata</i> Klatt	Calvinia district, shale flats
20. <i>G. spiralis</i> (Burch) De Vos ex Goldbl.	Sutherland district, W Karoo flats
21. <i>G. karooica</i> Goldbl.	Matjesfontein Karoo, S-facing shale slopes
Section <i>Pusilla</i> Goldbl.—1 sp.	
22. <i>G. pusilla</i> (Andr.) Klatt	damp shady places, Peninsula and surrounding hills
Section <i>Includanthera</i> Goldbl.—2 spp.	
23. <i>G. esterhuyseniae</i> Goldbl.	Great Winterhoek Mts., rocky S slopes at 2,000 m
24. <i>G. cedarmontana</i> Goldbl.	Central Cedarberg above 1,200 m, steep S slopes
Section <i>Angustifolia</i> Goldbl.—11 spp.	
25. <i>G. lithicola</i> Goldbl.	lower slopes of the Kogelberg Mts., in rocky ground
26. <i>G. purpurascens</i> Goldbl.	SW Cape, sandy flats at isolated sites between Stellenbosch and Piketberg
27. <i>G. humilis</i> (Thunb.) Ker	sandy flat places, Cape Peninsula and Flats
28. <i>G. darlingensis</i> Goldbl.	local in damp flats around Darling
29. <i>G. hispidula</i> (Foster) Goldbl.	sandy flats and slopes, Peninsula to Albertinia
30. <i>G. pappei</i> Baker	rare, sandy mt. soils, SW Cape
31. <i>G. intermedia</i> Goldbl.	rare, mts. between Simonsberg and Porterville
32. <i>G. unifolia</i> Goldbl.	high elevations in the Cedarberg
33. <i>G. juncea</i> (Link) A. Dietr.	sandy flats and slopes, Caledon to Pakhuis Pass
34. <i>G. furva</i> Ker ex Baker	SW Cape, stony lowlands between Paarl and Gouda
35. <i>G. stenosiphon</i> Goldbl.	Hexberg, Cold Bokkeveld Mts.
Section <i>Ixiopsis</i> Goldbl.—5 spp.	
36. <i>G. umbrosa</i> Lewis	mid to upper elevations, Peninsula and Hottentots Holland to the Cedarberg
37. <i>G. alticola</i> Goldbl.	higher peaks, Bains Kloof to Wemmershoek
38. <i>G. hesperanthoides</i> Schltr.	damp and marshy slopes, Bains Kloof to Bredasdorp
39. <i>G. cataractarum</i> Goldbl.	waterfalls and damp cliffs, Bettys Bay to Hermanus
40. <i>G. nubigena</i> Goldbl.	higher mts., Gt. Winterhoek to Kogelberg Mts.

TABLE 1. Continued.

Section *Engysiphon* (Lewis) Goldbl.—7 spp.

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|--|---|
| 41. <i>G. brevituba</i> (Lewis) Goldbl. | Piketberg Mts. |
| 42. <i>G. schinzii</i> (Baker) Goldbl. | mts. of the Caledon district |
| 43. <i>G. longifolia</i> (Lewis) Goldbl. | stony often shale soils, Michells Pass to Gifberg |
| 44. <i>G. confusa</i> Goldbl. | stony mountain soils, French Hoek to Gifberg |
| 45. <i>G. bonae-spei</i> Goldbl. | S Cape Peninsula |
| 46. <i>G. tenella</i> Goldbl. | sandy flats and dunes, Darling to Bredasdorp |
| 47. <i>G. exscapa</i> (Thunb.) Goldbl. | sandy flats and plateaus, Blouberg to Hondeklipbaai |

Subgenus *Geissorhiza*Section *Intermedia* Goldbl.—2 spp.

- | | |
|-----------------------------------|---|
| 48. <i>G. similis</i> Goldbl. | sandy slopes and flats, Cape Peninsula to Bains Kloof |
| 49. <i>G. scillaris</i> A. Dietr. | sandy slopes and plateaus, Caledon to the Cedarberg |

Section *Geissorhiza*—10 spp.

- | | |
|--|---|
| 50. <i>G. imbricata</i> (de la Roche) Ker
subsp. <i>imbricata</i>
subsp. <i>bicolor</i> (Thunb.) Goldbl. | Cape Peninsula to Bredasdorp
W Cape, wet sandy flats |
| 51. <i>G. purpureolutea</i> Baker | W Cape coastal belt, wet flats |
| 52. <i>G. barkerae</i> Goldbl. | wet marshy sites at foot of the Piketberg |
| 53. <i>G. louisabolusiaae</i> Foster | Olifants River Valley around Citrusdal |
| 54. <i>G. brehmii</i> Eckl. ex Klatt | seasonal pools in the SW Cape |
| 55. <i>G. sulphurascens</i> Foster | wet sandy soils, Nieuwoudtville Escarpment |
| 56. <i>G. minuta</i> Goldbl. | rare in wet sites in the Pakhuis Mts. |
| 57. <i>G. eury stigma</i> L. Bolus | rare, Darling to Kalabaskraal |
| 58. <i>G. mathewsii</i> L. Bolus | rare, around Darling, vlei margins |
| 59. <i>G. radians</i> (Thunb.) Goldbl. | damp sites, SW Cape from Gordons Bay to Saldanha |

Section *Monticola* Goldbl.—8 spp.

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|---------------------------------------|---|
| 60. <i>G. burchellii</i> Foster | middle elevations, Bains, Kloof to the Langeberg |
| 61. <i>G. grandiflora</i> Goldbl. | mts. among rocks, Gt. Winterhoek to the Langeberg |
| 62. <i>G. tabularis</i> Goldbl. | semi marshy places, Table Mt., Cape Peninsula |
| 63. <i>G. ramosa</i> Ker ex Klatt | mt. slopes, Hermanus to Tulbagh |
| 64. <i>G. bryicola</i> Goldbl. | waterfalls and stream edges, Hermanus Mts. |
| 65. <i>G. scopulosa</i> Goldbl. | high altitudes, Hex River Mts. |
| 66. <i>G. ciliatula</i> Goldbl. | high altitudes, Cedarberg |
| 67. <i>G. pseudinaequalis</i> Goldbl. | damp mt. slopes and cliffs, Ceres to Stellenbosch |

Section *Planifolia* Goldbl.—4 spp.

- | | |
|-------------------------------------|--|
| 68. <i>G. aspera</i> Goldbl. | sandy flats and slopes, W Cape |
| 69. <i>G. inaequalis</i> L. Bolus | W Cape mts., Bains Kloof to Nieuwoudtville |
| 70. <i>G. monanthos</i> Eckl. | W Cape coast, often on granite outcrops |
| 71. <i>G. tulbaghensis</i> F. Bolus | clay flats, Tulbagh |

Section *Ciliata* Goldbl.—10 spp.

- | | |
|---|--|
| 72. <i>G. namaquensis</i> Barker | Namaqualand, Kamiesberg to S Richtersveld |
| 73. <i>G. kamiesmontana</i> Goldbl. | local in the Kamiesberg above 4,000 ft. |
| 74. <i>G. divaricata</i> Goldbl. | Nieuwoudtville Escarpment and Gifberg |
| 75. <i>G. subrigida</i> L. Bolus | Nieuwoudtville Escarpment |
| 76. <i>G. heterostyla</i> L. Bolus | widespread, S Cape to Worcester and N through the Roggeveld to S Namaqualand |
| 77. <i>G. arenicola</i> Goldbl. | Nieuwoudtville Escarpment and Gifberg |
| 78. <i>G. splendidissima</i> Diels | near Nieuwoudtville |
| 79. <i>G. inflexa</i> (de la Roche) Ker | SW Cape, Bredasdorp to Piketberg, shale slopes and flats |
| 80. <i>G. erubescens</i> Goldbl. | Pakhuis Pass, shale slopes |
| 81. <i>G. leipoldtii</i> Foster | Clanwilliam to Bidouw valley, shale soils |

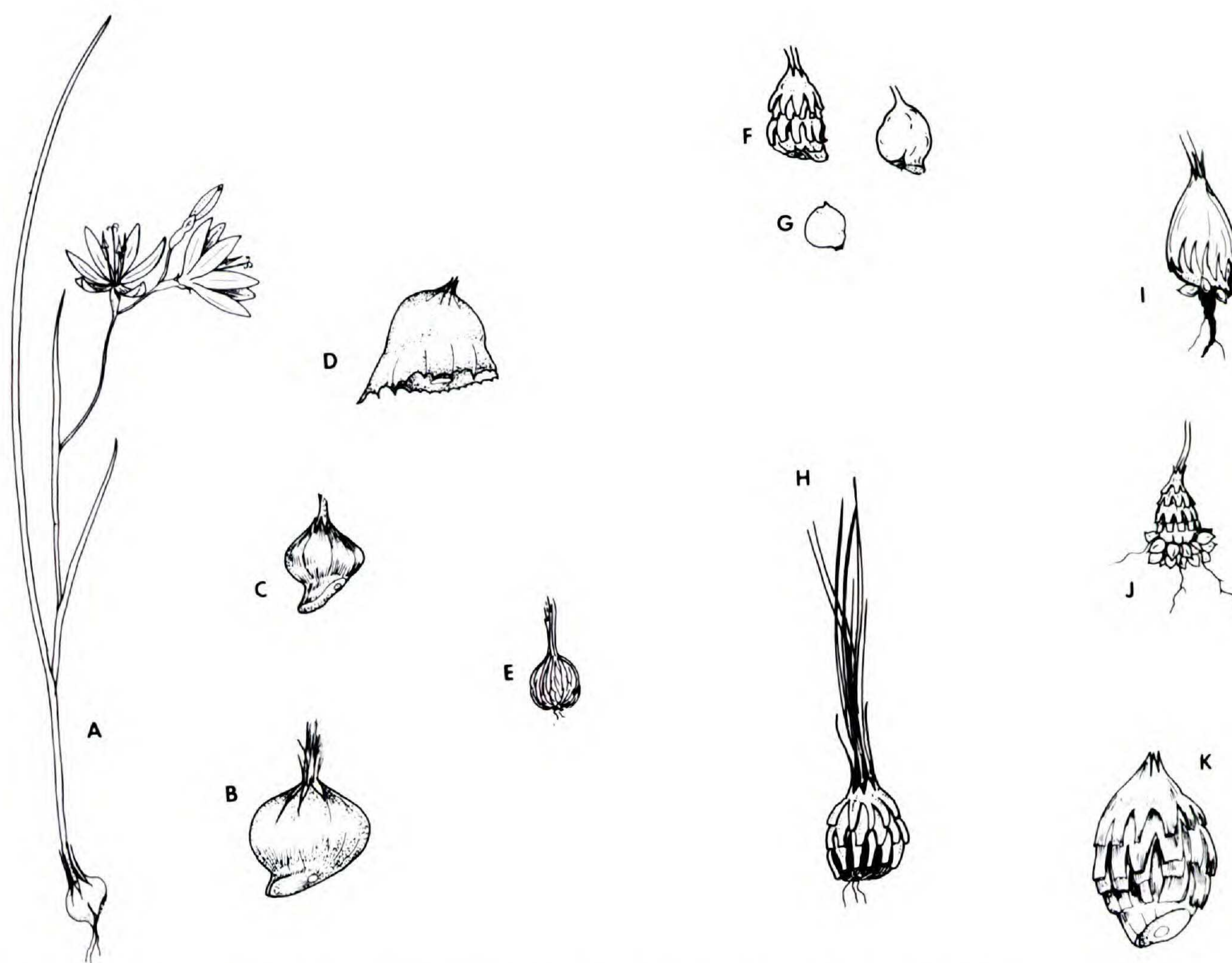


FIGURE 13. Corm morphology in *Geissorhiza*. A–E. Subgenus *Weihea*. F–K. Subgenus *Geissorhiza*.—A. *G. furva*.—B. *G. ovata*.—C. *G. juncea*.—D. *G. ornithogaloides* subsp. *ornithogaloides*.—E. *G. hesperanthoides*.—F, G. *G. inflexa* with tunic layers progressively removed and G. the naked corm.—H. *G. scillaris*.—I. *G. grandiflora*.—J. *G. monanthos* with numerous cormlets around the base.—K. *G. aspera* (all more or less life size except A, $\times 0.5$).

the older tunics is usually easy to recognize, but occasionally the displacement is minimal and the corm type can be difficult to determine.

The difference in the corm types in *Geissorhiza* is so marked and is correlated with other important features in that it is considered a fundamental character in the genus and the basis for the recognition of subgenera. Species with concentric tunics are assigned to subgenus *Weihea* while those with imbricate tunics fall in subgenus *Geissorhiza*.

In both subgenera, species growing in perennially moist to wet habitats tend to have much softer textured tunics, and this is believed to be a secondary development. This occurs in other genera with typically hard corm coverings and cannot be considered significant above the species or sectional rank. This condition is most extreme in *Geissorhiza outeniquensis*, and *G. cataractarum*, species that grow close to permanent water. The corm coverings of *G. hesperanthoides*, *G.*

nubigena, and some forms of *G. umbrosa* are most unusual in being composed of reticulate fibers. The relatives of these closely allied species have soft textured, concentric tunics, and they are clearly members of subgenus *Weihea*.

In subgenus *Weihea*, the corms of section *Engysiphon* are unusually large and the tunics particularly hard and persistent so that species of this group can often be recognized from their corms alone. In this subgenus, the corms of *Geissorhiza ornithogaloides* subsp. *ornithogaloides* and *G. malmesburiensis* are also distinctive (Fig. 13) in having a broad, oblique to horizontal base, and the tunic layers are serrated below.

In subgenus *Geissorhiza*, the corms are uniform in sections *Geissorhiza*, *Planifolia*, and *Ciliata*, being hard, woody, and dark colored. In section *Monticola*, the tunics tend to be softer and less persistent, possibly reflecting their montane and less extreme habitat. The pale tunics of *G. similis* and *G. scillaris*, assigned to section

Intermedia, have already been mentioned. It is not clear whether the forms of these two species represent a convergent development or are simply a variation or modification of the basic imbricate type of subgenus *Geissorhiza*. In the absence of further information, it is regarded as the latter and accordingly the section is included in this subgenus.

LEAVES

Cataphyll. There is usually a single transparent and membranous cataphyll sheathing the stem base below ground. It is often lacking or fragmentary in dry material and seldom distinctive. Occasionally, the cataphyll is firm textured, persistent and brown, and forms a characteristic feature of species like *Geissorhiza erubescens*, *G. divaricata*, *G. parva*, and *G. ovata*.

Foliage leaves. These are defined as having a free, monofacial apex as opposed to stem bracts which are entirely sheathing. There may be from several to only three, less often two, and one only in *Geissorhiza unifolia*. The leaf number in most species is constant. The primitive state is presumed to be several and indeterminate as in *G. foliosa*, *G. bracteata*, and *G. inconspicua* (all section *Weihea*). Leaf number has stabilized at three in many species of both subgenera, where the most frequently encountered condition is two basal or nearly basal and long leaves and a third cauline and shorter, partly sheathing leaf. This uppermost leaf occasionally has a somewhat inflated and spathe-like sheath, or it may be reduced and entirely sheathing in which case it is regarded as a bract rather than a leaf. In *G. scillaris* only two leaves are produced, the lower with a long free lamina and the upper also long but sheathing for almost its entire length.

The basic leaf type in the genus, as for Iridaceae in general, is ensiform and equitant with a plane lamina in which the margins and the midrib can be readily distinguished but are not substantially thickened or raised. This basic leaf ground plan has been more extensively modified in *Geissorhiza* than in any other genus of the family with the possible exception of *Gladiolus* (Fig. 14).

The simplest modification is a narrowing from ensiform to linear, a common feature of species in the most primitive section *Weihea*. Among the species with plane leaves, *G. pusilla* stands out in having partly pubescent leaves. The species is unusual in several ways and has been assigned to its own section, *Pusilla*. Unusual broad, often

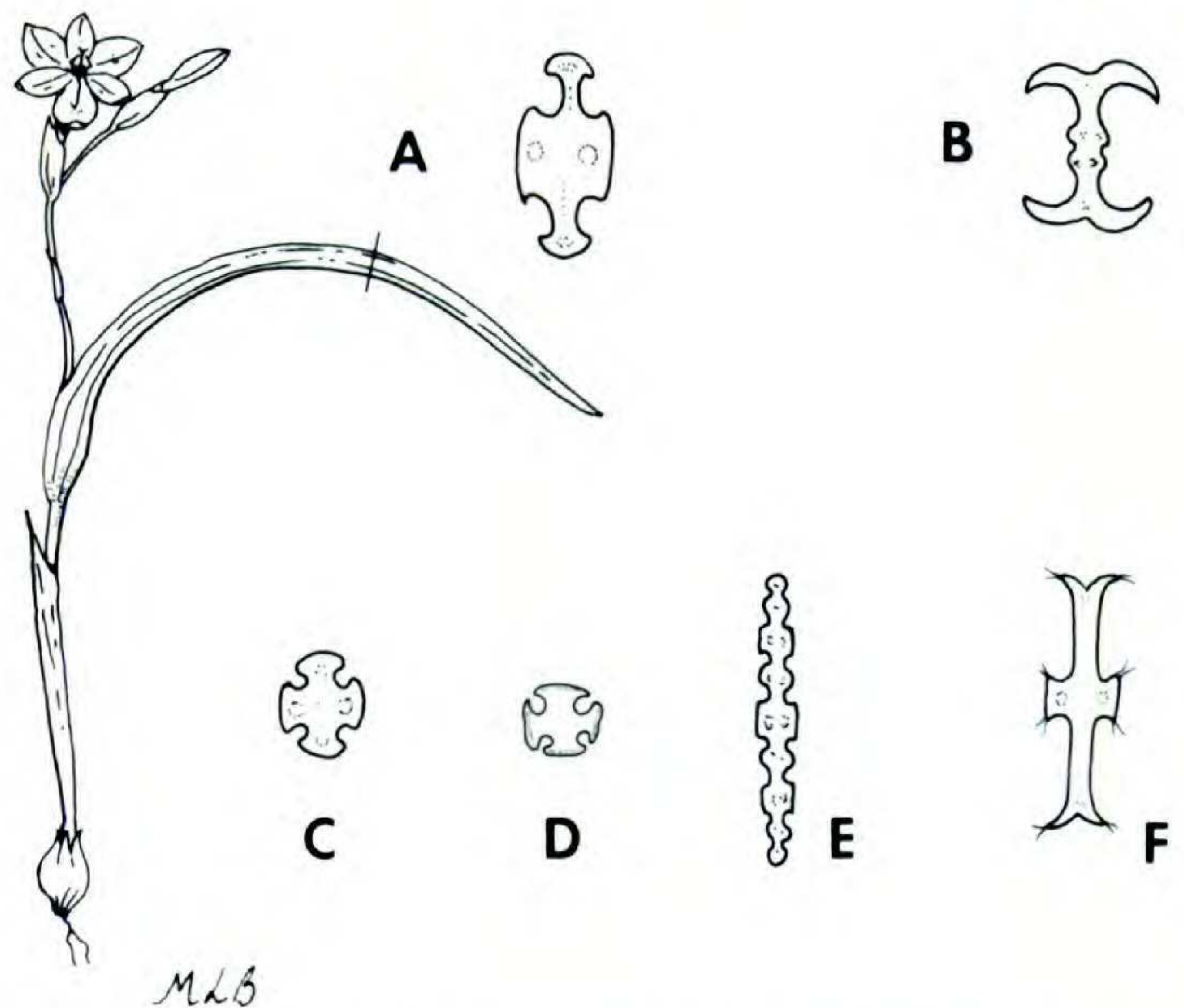


FIGURE 14. Leaf morphology of *Geissorhiza*.—A. *Geissorhiza unifolia* with enlarged transverse section showing the raised midrib area and margins.—B. *G. bonae-spei*, margins winged but midrib not thickened.—C. *G. scillaris*, heavily thickened margins and midrib.—D. *G. juncea*, terete 4-grooved leaf.—E. *G. imbricata*, ribbed leaf.—F. *G. leipoldtii*, leaf margin wings and edges of raised midrib ciliate (whole plant life size; leaf sections much enlarged).

ovate and prostrate or nearly prostrate leaves are found in *G. ovata* and sometimes *G. parva*.

A more complex development is a thickening of the margins and the midrib so that the leaves become distinctly 2-channelled on each surface (Fig. 14A, C), and the edges of the thickened margins are sometimes minutely ciliate. Leaves of this type occur in some species of subgenus *Weihea*, in sections *Angustifolia*, *Ixiopsis*, and *Engysiphon* as well as in subgenus *Geissorhiza*. In *G. exscapus*, *G. tenella*, and *G. bonae-spei* of section *Engysiphon*, the margins are raised, forming wings held at right angles to the blade while the midrib is hardly raised at all. These leaves are thus H-shaped in cross section (Fig. 14B).

A narrowing of the blade is evident in *Geissorhiza humilis* and *G. hispidula*, and in both these species the leaves are sticky so that soil adheres to the lamina even when dry. With the contraction of the blade width, the longitudinal channels become narrowed to thin grooves. Such leaves are found in section *Ixiopsis* of subgenus *Weihea* and occasionally in species of other sections, notably *G. radians* and *G. sulphurascens* of section *Geissorhiza*. In a few species, e.g., *G. juncea*, *G. furva*, *G. brehmii*, *G. louisabolusiae*, *G. stenosphon*, and *G. fourcadei*, the blade is

terete (Fig. 14D), but the narrow grooves, indicating their ancestry, are preserved and can be seen in cross section or even in intact leaves under the dissecting microscope.

In subgenus *Geissorhiza*, the leaves of species in section *Ciliata* are distinctive in having the margins extended to form wings held at right angles to the blade (Fig. 14F), the midrib also raised and winged, and their edges are ciliate to pubescent. In *G. subrigida*, and robust forms of *G. inflexa*, *G. divaricata*, and sometimes other species of the section, secondary veins may also be raised and ciliate.

The leaves of most species of section *Geissorhiza* are unusual in having several veins as well as the margins heavily thickened so that the blade is several ribbed and grooved (Fig. 14E). The sheathing part of the third and uppermost leaf in this alliance is inflated and also heavily ribbed and grooved, and this character is preserved even when the lamina has become narrow and only 2-grooved (*G. radians*, *G. sulphurascens*, forms of *G. imbricata*) or terete (*G. brehmii*, forms of *G. louisabolusiae*).

Bract leaves. These appear to be modified upper leaves in which the free part of the lamina has been suppressed. They range from green and leaf-like, but entirely sheathing, to membranous and even scale-like. The presence of a bract leaf is typically constant for a species and is present even when the stem is unbranched. Such bracts are a diagnostic feature of *G. scillaris*, *G. heterostyla*, and all species of section *Monticola*.

STEM

The stem is typically erect, smooth, terete, and produced well above the ground. It is usually sheathed below by leaf bases, and in many species the third leaf is specialized as a sheath which envelopes the lower part of the stem. The upper half of the stem may be naked, or bear a specialized bract leaf (see above). The stem is densely (or occasionally sparsely) ciliate in all the species of section *Planifolia*, in several of section *Ciliata*, and in *G. ciliatula* and *G. scopulosa* (section *Monticola*) (all subgenus *Geissorhiza*) and in two isolated species, *G. intermedia* and *G. unifolia*, of subgenus *Weihea*, section *Angustifolia*.

Branching is variable, but certain species typically do not produce any branches, while extensive branching is characteristic only of several species of section *Monticola*, such as *G. ramosa*, *G. burchellii*, and *G. tabularis*. Branching is sup-

pressed in all species of sections *Angustifolia* and *Ixiopsis*.

INFLORESCENCE

The inflorescence in *Geissorhiza* is, with a few exceptions, a spike of several flowers and may be more or less straight to flexuose. The number of blooms is variable depending on age and health of the plants and seasonal and soil conditions. A few scattered species in subgenus *Weihea* have solitary flowered stems, thus technically not true spikes. These include all three species of section *Tortuosa* (*G. corrugata*, *G. karooica*, and *G. spiralis*) and *G. delicatula* and *G. fourcadei* (section *Weihea*).

The spike is typically drooping in bud, and straightens gradually from the base as the flowers open progressively. This drooping is seldom evident in dried material and although not determined for all the species, appears to be a feature of the genus.

The flowers are subtended by paired, opposed bracts, a larger outer enclosing the smaller inner. The inner bract (sometimes called a bracteole), used very little as a taxonomic character, is a double structure with two main veins and a forked apex. While the inner bract may be as long or slightly longer than the outer bract, it is always smaller and narrower. Only in section *Engysiphon* are the inner bracts substantially shorter than the outer, and this is one of the diagnostic features of the section.

The outer bracts are usually herbaceous with a hyaline upper margin, and firm in texture, but often become dry from the apex soon after blooming. In subgenus *Geissorhiza*, sections *Planifolia* and *Ciliata*, the bracts become dry and ferrugineous in the upper half. This is particularly well developed in *G. aspera*, *G. monanthos*, *G. inflexa*, and *G. subrigida*. There is little to distinguish the bracts of other species with the exception of the members of section *Engysiphon* in which they are very large, up to 50 or 60 mm in some species, but only 15–20 mm long in *G. brevītuba*, and much longer than the quite membranous inner bracts. *Geissorhiza humilis* and *G. hispidula* are distinctive in having sticky bracts, to which sand adheres even when the plants are dried.

FLOWER

Most species of *Geissorhiza* have a simple, actinomorphic flower with a short, straight, cylindric perianth tube and horizontally extended te-

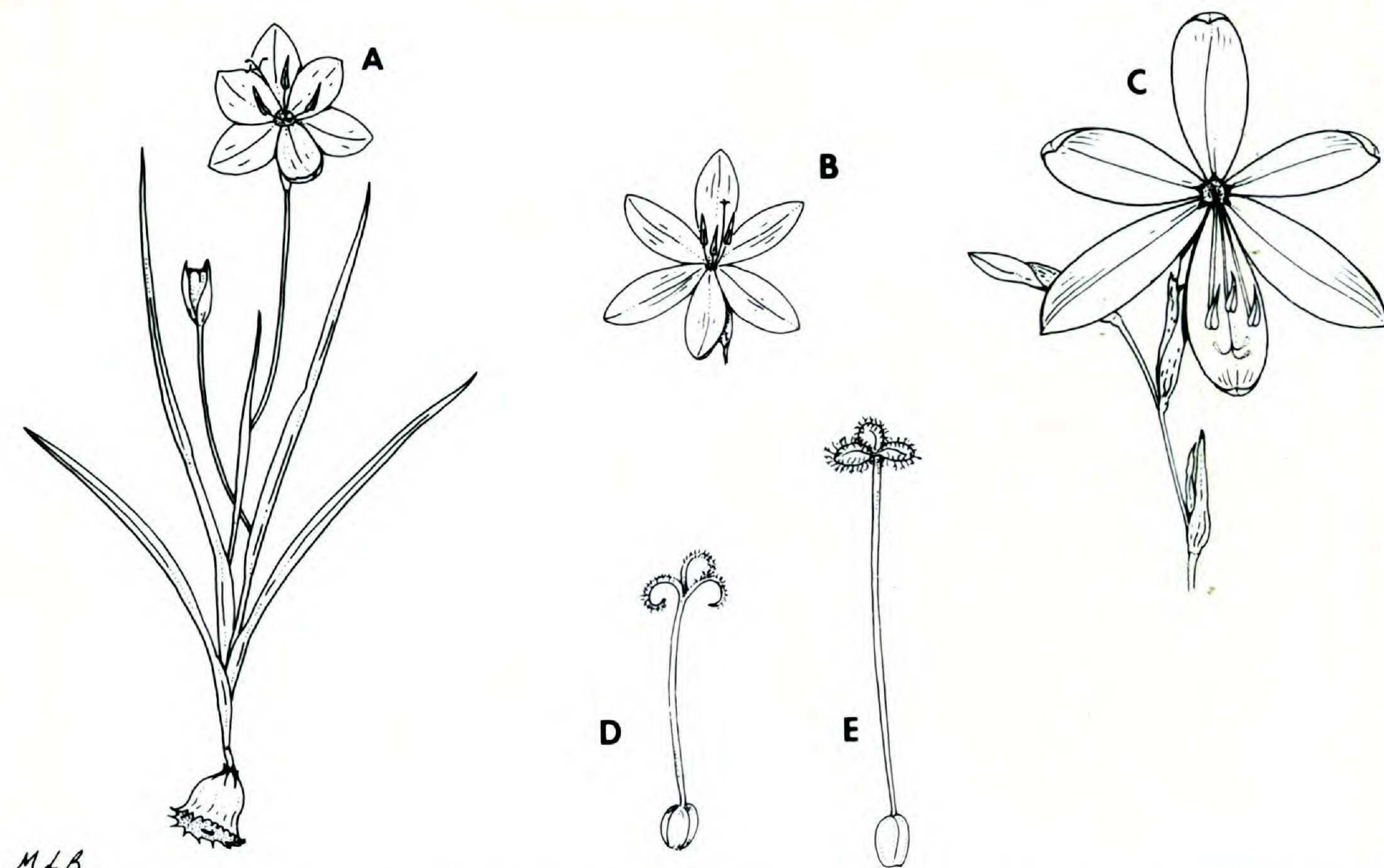


FIGURE 15. Floral features of *Geissorhiza*.—A. *G. ornithogaloides*, actinomorphic stellate flower with deflexed style.—B. *G. aspera*, stellate flower with unequal stamens.—C. *G. grandiflora*, zygomorphic flower with declinate stamens and style.—D. *G. imbricata*, typical style with short recurved branches.—E. *G. eurystigma*, the broad flat ciliate style branches found in this species (A–C life size; D–E $\times 2$).

pals (Fig. 15A, B). The tube generally reaches to about the apex of the bracts surrounding the tube, but after fertilization it may become exerted a few millimeters due to the enlargement of the ovary. The style is slender and exerted well beyond the mouth of the tube and ultimately divides into three relatively short, recurved branches. The three stamens are usually symmetrically disposed, with the filaments inserted below the mouth of the perianth tube and well-exserted from the tube. The stamens vary considerably and are dealt with in more detail below.

Longer perianth tubes that are exerted for more than 1 or 2 mm from the bracts are unusual and are scattered throughout the genus. In subgenus *Weihea*, *G. ovata* (section *Weihea*), *G. nubigena* (section *Ixiopsis*), *G. stenosiphon* (section *Angustifolia*), and both *G. esterhuyseniae* and *G. cedarmontana* (section *Includanthera*) have unusually long perianth tubes. In section *Engysiphon*, the long perianth tube is accompanied by long bracts, and the tube may reach only to the apex of the bracts (*G. schinzii*, *G. bonae-spei*) or be exerted for some distance (*G. exscapa*, *G. confusa*, *G. tenella*).

Short perianth tubes that reach only to about

the midline of the bracts are regarded as derived since they occur only in specialized species or sections, while moderately long tubes are found in the less specialized species and in related genera. These short tubes are characteristic of a few species in subgenus *Weihea*, notably *G. alticola* (section *Ixiopsis*), in sections *Planifolia* and *Ciliata*, and in several species of section *Geissorhiza*, all subgenus *Geissorhiza*. In these species, the bracts become dry at flowering time and are folded back in the midline by the outspread tepals.

Zygomorphic flowers appear to have evolved repeatedly in both subgenera (Figs. 5, 6, 11, 12, 15). In the zygomorphic flowers in *Geissorhiza*, the stamens are unilateral and decumbent, and lie above the anterior tepal (Fig. 15C). The style is also decumbent, and it lies under the stamens. This situation is unusual in Iridaceae where zygomorphic flowers typically have erect and unilateral stamens, arcuate under an erect and often hooded anterior tepal. In subgenus *Weihea*, zygomorphy is developed in *G. roseoalba* and *G. outeniquensis* (section *Weihea*), in *G. karooica* (section *Tortuosa*), and in all species of section *Engysiphon*, while in subgenus *Geissorhiza*, zy-

gomorphic flowers are found in *G. tulbaghensis* and *G. monanthos* (section *Planifolia*), in *G. radians* and *G. barkerae* (section *Geissorhiza*), and in *G. grandiflora* (section *Monticola*).

Flower colors of white to cream or shades of violet to purple are most common in *Geissorhiza* (Figs. 1–12), but all colors except shades of orange occur. Except for occasional mutants, populations and even species are uniform in their flower color. *Geissorhiza inflexa* stands out in having populations of white, purple, pink, or deep red flowers. Unusual color combinations occur in several species. In *G. barkerae*, most forms of *G. purpureolutea* and some of *G. brehmii* and *G. imbricata* (all section *Geissorhiza*), and in some populations of *G. inflexa* the cream to yellow flowers have a dark purple to brown center. *Geissorhiza eurystigma*, *G. radians*, and *G. mathewsii* (section *Geissorhiza*) and forms of *G. monanthos* have dark violet flowers marked with contrasting concentric bands of white and dark red (Figs. 10–11).

STAMENS

The three stamens typically have well-developed and equal filaments inserted in the perianth tube shortly below the mouth. The two species of section *Includanthera*, *G. cedarmontana* and *G. esterhuyseniae*, are remarkable in having very short filaments inserted near the base of the perianth tube, so that the stamens are entirely included in the tube.

An unusual feature of subgenus *Geissorhiza* is the presence in many species, of unequal filaments, one being consistently shorter, by at least 0.5 but up to 3 mm, than the other two (Fig. 15B). While this development appears to have arisen independently in each section (excepting section *Intermedia* where the character is not present), it is probably fundamental in the subgenus, although only expressed in certain species. In section *Monticola*, unequal filaments occur in all species except the very dwarf *G. ciliatula*, while in section *Planifolia*, unequal filaments occur consistently only in *G. inaequalis* and occasionally in *G. aspera* and *G. monanthos*. In section *Geissorhiza*, only *G. barkerae* and in section *Ciliata*, *G. heterostyla* consistently have a shorter filament, while this occurs occasionally in *G. louisabolusiae* (section *Geissorhiza*) and *G. leipoldtii* (section *Ciliata*).

The anthers are usually somewhat longer than the filaments, and erect to ascending. In those

species with declinate stamens, the anthers are erect and thus held at right angles to the decumbent filaments. In *G. esterhuyseniae* and *G. cedarmontana* (section *Includanthera*), the anthers are included in the perianth tube. Anther size is a generally useful taxonomic character as it is fairly constant in a species, easy to measure, and a good indication of overall flower size.

GYNOECIUM

Style. The style is filiform, slender, and well exerted from the perianth tube. Ultimately it divides into three comparatively short and slender recurved branches (Fig. 15A–D). This character distinguishes the genus from the allied *Hesperantha* and varies very little. In *Geissorhiza cedarmontana* and *G. esterhuyseniae* (section *Includanthera*), however, the style is short and entirely included in the perianth tube while in the striking *G. stenosphon*, the style may divide anywhere between the mouth of the perianth tube and the base of the anthers. The style typically diverges to some degree from an upright position in all species, but is decumbent and placed under the declinate stamens in zygomorphic species (Fig. 15C). In some populations of *G. heterostyla*, individuals may have either long (i.e., normal styles), medium, or short styles that reach only to the apex of the perianth tube (Bolus, 1930), hence the name given the species by Bolus. The anthers do not vary at all in length, so that the condition is not true heterostyly. This is presumably an adaptation to promote outcrossing.

Two species, *Geissorhiza eurystigma* and *G. mathewsii* (section *Geissorhiza*), have distinctive, broad flat style branches (Fig. 15E), described by Lewis (1954) as flat, thick, and crenate edged. The style branches of these two species are so unusual that they can immediately be recognized from this character alone.

Ovary. The oblong to ovoid ovary has little taxonomic value, and, apart from minor size differences, there is little to distinguish species on this character.

FRUIT

The fruit is a thin walled loculicidal capsule, typically more or less ovoid-oblong in shape. The ovary develops rapidly after fertilization, and generally grows to reach the apex of the bracts before maturing. The bracts enclose, to some extent, the young fruits but in the later stages of development the bracts become dry and broken.

The species of section *Engysiphon* stand out in having exceptionally long capsules that are more or less fusiform in shape. The capsules are entirely included in the long bracts of these species.

Seeds are basically turbinate to globose in shape with a persistent funicle and a testa of uncontorted epidermal cells with smooth surfaces. Deviations from this basic type include increasing compression, resulting in a more or less angular to irregular shape and the wrinkling and crumpling of the epidermal cells (Wagner & Goldblatt, 1984). Although the seeds of only a few species have been examined, seed structure appears relatively uniform and of limited taxonomic value, differences being mainly of size.

CYTOLOGY

Geissorhiza is relatively uniform cytologically. Basic chromosome number is $x = 13$ (Gwynne, 1958; Goldblatt, 1971), this coming from counts for 11 species. Additional studies here, including original counts for 32 species (Table 2), of which 30 are first reports for species, confirm the base number established in 1971. The cytological technique employed involved root tip squashes in contrast to the paraffin section method which I used in earlier studies of the genus. Details of the technique are described elsewhere (Goldblatt, 1979b, 1980) and consist of a pretreatment in hydroxyquinoline, fixation in absolute ethanol:glacial acetic acid (3:1), and a 5–6 minute hydrolysis in 10% HCl prior to squashing in orcein based stains.

A total of 41 species, over half the genus, is now known cytologically. Counts for most species, including as many as five or six populations of some, are diploid, $2n = 26$. Exceptions are *G. bracteata* (one count) and *G. inaequalis* (two counts), both tetraploid; *G. aspera* which has both diploid and tetraploid populations; and *G. bolusii*, where the five populations examined are triploid, $2n = 39$. B chromosomes have been recorded in *G. heterostyla*, $2n = 26$ and $2n = 26 + 2B$, *G. inflexa*, *G. bryicola*, and *G. tulbaghensis*, $2n = 26 + 1B$.

The basic number of $x = 13$ is somewhat unusual in Iridaceae, but it is shared by the closely related *Hesperantha* (Goldblatt, 1971, 1984) and the mono- or di-typic *Schizostylis* (Goldblatt, 1971). The karyotype is similar in all three genera and consists of fairly small meta- to submeta-centric chromosomes that with the methods employed, range in size from 2.5–4 μm .

INFRAGENERIC CLASSIFICATION AND CLADISTICS

The classification adopted here rests on the primary assumption that the peculiar imbricate corm tunics found in many species of *Geissorhiza* arose once in the evolution of the genus. The recognition of the two subgenera proposed here is thus based on the nature of the corm tunics, species of subgenus *Geissorhiza* having imbricate tunics and species of subgenus *Weihea*, the presumably ancestral concentric tunics. Several other characters are correlated with the presence of imbricate corm tunics, all apparently specialized and restricted, or nearly so, to subgenus *Geissorhiza*, though not found in all species. These include leaf margin and midrib pubescence, corrugate leaves, ferruginous bracts, unequal stamens, and stem puberulence (or ciliation).

Other major morphological specializations in *Geissorhiza* such as leaf margin and midrib thickening and development of floral zygomorphy seem to have arisen independently, in both the basal subgenus *Weihea* and the derived subgenus *Geissorhiza*. Both these types of specialization occur in other genera of Iridaceae and in this light seem secondary to the evolution of imbricate tunics, and in fact, both appear to have evolved more than twice in each subgenus.

SECTIONAL CLASSIFICATION IN SUBGENUS *WEIHEA*

Seven sections are here recognized in subgenus *Weihea*, sections *Weihea*, *Tortuosa*, *Pusilla*, *Includanthera*, *Angustifolia*, *Ixiopsis*, and *Engysiphon*. Subgenus *Weihea*, the largest with 18 species, corresponds closely to Foster's subsection *Foliosae*. It is diverse and includes several lineages, rather poorly differentiated, and is united by the unspecialized combination of concentric corm tunics and plane, usually ensiform to linear leaves without well-developed thickening of the margins or midrib. The flowers of the majority of species are also unspecialized, with tubes of moderate length, exerted and equal stamens. *Geissorhiza ovata* stands out in the section in having an unusually long perianth tube and nearly prostrate, ovate leaves, while *G. roseoalba* and *G. outeniquensis* have unusually large flowers that are zygomorphic and declinate. *Geissorhiza fourcadei* stands out here in its terete leaves and large flowers that are solitary on the branches.

TABLE 2. Chromosome numbers in *Geissorhiza*. Original counts are marked with an asterisk (*). Previous counts were reported by Goldblatt (1971) except as indicated in the table, by Gwynne (1958).

Species	Diploid Number	Collection Data
<i>G. arenicola</i>	26*	W of Nieuwoudtville, <i>Goldblatt</i> 7056 (MO)
<i>G. aspera</i>	26	without locality or voucher (Gwynn, 1958—as <i>G. secunda</i>)
	26*	Rondebosch Common, <i>Goldblatt</i> 5350 (MO); Burghers Pos, Darling, <i>Goldblatt</i> s.n. (no voucher); Olifants River Valley, near Rondegat, <i>Goldblatt</i> 5647 (MO)
	52	Cape Peninsula, Signal Hill, <i>Goldblatt</i> 213 (BOL); Simonstown, <i>Goldblatt</i> 520 (BOL)
	52*	Caledon, Albertyn road near Leeu River, <i>Goldblatt</i> 4839A (MO); St. James, Cape Peninsula, slopes below Boyes Drive, <i>Goldblatt</i> s.n. (no voucher)
<i>G. barkerae</i>	26*	N of Piketberg, <i>Goldblatt</i> 6391 (MO)
<i>G. bolusii</i>	39	Bains Kloof, <i>Goldblatt</i> 458 (BOL); Cape Peninsula, Grootkop, <i>Goldblatt</i> 515 (BOL)
	39*	Villiersdorp, High Noon, <i>Goldblatt</i> s.n. (no voucher); Paarl, Simonsberg, <i>Esterhuysen</i> 35281A (MO); Jonaskop, Riviersonderend Mts., <i>Goldblatt</i> 6444 (MO)
<i>G. bonae-spei</i>	26*	Cape Peninsula, opposite Cape Point Reserve, <i>Goldblatt</i> 5267 (MO)
<i>G. bracteata</i>	ca. 52*	Hankey, Klein River Valley, <i>Goldblatt</i> 4933 (MO)
<i>G. brevitiba</i>	26	Piketberg, top of Versveld Pass, <i>Goldblatt</i> 204 (BOL) (as <i>Engysiphon</i>)
<i>G. bryicola</i>	26*	Vogelgat, Hermanus, <i>Goldblatt</i> 6741 (MO)
	26 + B*	Vogelgat, Hermanus, <i>Goldblatt</i> 6742 (MO)
<i>G. burchellii</i>	26*	Swellendam, Langeberg, <i>Esterhuysen</i> 35363 (MO)
<i>G. cataractarum</i>	26*	Caledon, cliffs above Bettys Bay, <i>Goldblatt</i> 5355 (MO)
<i>G. cedarmontana</i>	26*	Cedarberg, Middelberg plateau, <i>Goldblatt</i> 5145 (MO)
<i>G. ciliatula</i>	26*	Cedarberg, Middelberg, <i>Goldblatt</i> 5144 (MO)
<i>G. confusa</i>	26	Bains Kloof, <i>Goldblatt</i> 483 (BOL) (as <i>Engysiphon exscapus</i>)
<i>G. corrugata</i>	26*	Calvinia, <i>Goldblatt</i> 3895 (MO)
<i>G. erubescens</i>	26*	Pakhuis Pass, <i>Goldblatt</i> 6396 (MO)
<i>G. exscapa</i>	26*	top of Vanrhyns Pass, <i>Goldblatt</i> 7061 (MO)
<i>G. grandiflora</i>	26*	Limietberg, Bains Kloof, <i>Goldblatt</i> 6828 (MO)
<i>G. heterostyla</i>	26	Voelvlei, Sutherland, <i>Hall</i> s.n. (NBG); Calvinia, <i>Goldblatt</i> 135 (J) (as <i>G. leipoldtii</i>)
	26*	Blomfontein road, W of Middelpoos, <i>Goldblatt</i> 5815 (MO); Grasberg road NW of Nieuwoudtville, <i>Goldblatt</i> 6265 (MO)
	26 + 2B*	Humansdorp, E of town, <i>Goldblatt</i> 5211 (MO)
<i>G. cf. hispidula</i>	26*	near Baardscheerdersbos, sandy flats, <i>Goldblatt</i> 5377 (MO)
<i>G. humilis</i>	26*	Cape Point, near Reserve, <i>Goldblatt</i> 5265 (MO)
<i>G. imbricata</i> subsp. <i>imbricata</i>	26	without locality, <i>Goldblatt</i> 165 (J)
<i>G. inaequalis</i>	52	Vanrhyns Pass, <i>Goldblatt</i> 129 (J); near Nieuwoudtville, <i>Goldblatt</i> 275 (BOL)
<i>G. inconspicua</i>	26*	near George, <i>Vlok</i> s.n. (no voucher)
<i>G. inflexa</i>	26*	Caledon, Queen Anne-Eseljagt, <i>Goldblatt</i> 2497 (MO); Caledon, W end of the town, <i>Goldblatt</i> 6173 (MO)
	26 + 1B*	Tulbagh cemetery, <i>Goldblatt</i> 5228 (MO)
<i>G. juncea</i>	26*	Cape Peninsula, Lions Head, <i>Goldblatt</i> 4700 (MO)
<i>G. kamiesmontana</i>	26*	Kamiesberg, Rooiberg slopes, <i>Goldblatt</i> 5770 (MO)
<i>G. karooica</i>	26*	Ghaap kop, Matjesfontein, <i>Goldblatt</i> 6371 (MO)

TABLE 2. Continued.

<i>G. longifolia</i>	26	Pakhuis Pass, <i>Goldblatt</i> 122 (J) (as <i>Engysiphon</i>)
	26*	N of Citrusdal, <i>Goldblatt</i> 6267 (MO)
<i>G. louisabolusiae</i>	26	Citrusdal, <i>Goldblatt</i> 247 (BOL)
<i>G. malmesburiensis</i>	26*	Malmesbury Commonage, <i>Goldblatt</i> 6282 (MO)
<i>G. nana</i>	26*	near Swellendam, <i>Goldblatt</i> s.n. (no voucher)
<i>G. ornithogaloides</i>	26	Caledon, <i>Goldblatt</i> 214 (BOL) (as <i>G. nana</i>)
subsp. <i>ornithogaloides</i>		
<i>G. outeniquensis</i>	26*	Outeniqua Pass, George, <i>Vlok</i> 525 (MO)
<i>G. ovata</i>	26	Bot River, <i>Goldblatt</i> 217 (BOL)
<i>G. pusilla</i>	26	Cape Peninsula, Signal Hill, <i>Goldblatt</i> 196 (BOL)
<i>G. roseoalba</i>	26*	Paardevlei Mts., Attaquaskloof, <i>Vlok</i> 706 (MO)
<i>G. scillaris</i>	26*	Elands Kloof, <i>Goldblatt</i> 5245 (MO)
<i>G. similis</i>	26*	Bains Kloof, <i>Goldblatt</i> s.n. (no voucher); mts. above Clovelly, Cape Peninsula, <i>Goldblatt</i> 7052 (MO)
<i>G. splendidissima</i>	26	Nieuwoudtville, <i>Goldblatt</i> 347 (BOL)
<i>G. tabularis</i>	26*	above Skeleton Gorge, Table Mt., <i>Goldblatt</i> 6726 (MO)
<i>G. tenella</i>	26*	S of Koeberg, <i>Goldblatt</i> 7111 (MO)
<i>G. tulbaghensis</i>	26 + 1B*	Tulbagh cemetery, <i>Goldblatt</i> 5227 (MO)

Section *Tortuosa* is a small segregate of section *Weihea*, restricted to the western Karoo. Two species have been added to the one assigned here by Foster. All three species are of small size, have large flowers, and are distinguished by having solitary flowered spikes.

The monotypic section *Pusilla* includes only the distinctive and taxonomically isolated Cape Peninsula species, *Geissorhiza pusilla*. It has a combination of features that suggest strongly a hybrid origin. Its concentric corm tunics are typical of subgenus *Weihea*, while the plane ensiform leaves are unusual for section *Weihea* in being pubescent. The very short-tubed flower and dry and ferrugineous floral bracts match exactly those found in sections *Geissorhiza* and *Ciliata*. This combination of the specialized features of subgenus *Geissorhiza* and the primitive concentric corm tunics of subgenus *Weihea* seems so discordant that an intersubgeneric hybrid origin is likely, although the possibility of an independent origin of the specialized short perianth tube and ferrugineous bracts cannot be discarded.

Section *Includanthera* comprises only *Geissorhiza cedarmontana* and the poorly known *G. esterhuyseniae*, corms of which have not been seen. The two species are united in having the stamens and the style included in the lower part of the long perianth tube. The affinity of these

two species is uncertain but they are assumed to be a monophyletic offshoot of section *Weihea*. *Geissorhiza esterhuyseniae* has the plane ensiform leaves typical of section *Weihea* while the leaves of *G. cedarmontana* have strongly thickened margins and midribs. Section *Includanthera* is restricted to the higher mountains of the western Cape.

The specialized and derived sections *Angustifolia* and *Ixiopsis* are closely allied. Both have three or fewer, narrow leaves with heavily thickened margins and midribs and stems in which branching is suppressed. Section *Angustifolia*, corresponding largely to Foster's subsection *Filiiformes*, comprises some 11 species, sharing unspecialized, usually small, actinomorphic flowers and small corms with hard woody tunics. Species usually have two basal leaves and a third, which is much smaller, inserted in the mid part of the stem, and partly sheathing. *Geissorhiza stenosiphon*, a very local endemic of the Cold Bokkeveld Mountains is remarkable in the section for its slender perianth tube some 4–5 cm long, and it stands out in the genus in having a style that divides between the mouth of the tube and the base of the anthers. This species, as well as *G. juncea* and *G. furva*, stands out in having terete, 4-grooved leaves. The poorly understood *G. intermedia* and *G. unifolia* are unique in sub-

genus *Weihea* in having lightly ciliate stems. The section is centered in the southwestern Cape, *G. unifolia* and *G. juncea* occurring as far north as the Cedarberg and *G. hispidula* ranging from the Cape Peninsula to the southern Cape near Albertinia.

The related section *Ixiopsis* comprises a close knit alliance of five species that are centered in the mountains of the southwestern Cape. Only one species, *Geissorhiza hesperanthoides* was known to Foster, who assigned it to his subgenus *Ixiopsis* together with three species subsequently removed to *Gladiolus*. All the species of the section occur in the southwestern Cape mountains between Bredasdorp and Tulbagh, and only *G. umbrosa* extends much outside this area, occurring as well on the Cape Peninsula and in the Cedarberg. In these species, the third leaf is typically reduced and entirely sheathing, and the corm tunics are soft in texture and either membranous or fibrous, most unusual for the genus.

Section *Engysiphon*, another close knit alliance, comprises seven species, united in having large, conspicuously veined zygomorphic and declinate flowers, usually with a very long perianth tube and long herbaceous bracts, the inner much smaller than the outer. The leaves have thickened to winged margins and the corms are typically large and have very hard woody tunics. The section, treated by Lewis (1941) as a separate genus and including one more species, here assigned to section *Weihea*, comprises two distinct assemblages, one in which the leaf has the thickened margins and midrib, also found in section *Angustifolia*, and the other in which the leaf has raised and winged margins that curve over the lightly thickened midrib. Despite the clear cut leaf differences, the two groups appear closely related and there seems no doubt that the section is monophyletic. The section has a markedly western distribution, species extending from the Caledon district north to Namaqualand.

SECTIONAL CLASSIFICATION IN SUBGENUS *GEISSORHIZA*

The species of subgenus *Geissorhiza* are united primarily by the possession of their characteristic imbricate corm tunics. These are remarkably uniform in the majority of species, especially in sections *Planifolia*, *Ciliata*, and *Geissorhiza*, being hard, dark in color, and regularly notched below. In section *Monticola*, there is a trend for the softening of the texture of the tunics, while in the

two species of section *Intermedia* the corm tunics stand out as being pale in color. Section *Intermedia* is the only one in subgenus *Geissorhiza* in which none of the species have unequal stamens, a character that is probably a part of the genotype in the other sections although it is not always expressed. Thus it is, for basically negative reasons, that section *Intermedia* has been recognized, and it stands out as an isolated and residual group of the subgenus, the species united by their pale imbricate corm tunics and the frequent specialized feature of narrow leaves with strongly thickened margins and midribs.

Section *Monticola* comprises a range of species, in which branching is normally well-developed, the stamens are distinctly unequal and the corm tunics are often soft in texture with an accompanying tendency for the tunics to become displaced easily. It then often becomes difficult to be certain of the type of tunics in some species. However, well-preserved corms in a few specimens or the associated characters of the species is usually sufficient to determine the sectional position. Only two species of the section were known to Foster (1941) who assigned them to his otherwise monophyletic subsection *Filiiformes*.

Section *Monticola* is centered in the mountains of the southwestern Cape, but it has a wide range, *G. ciliatula* occurring in the Cedarberg in the north and *G. burchellii* extending as far east as the Langeberg at Heidelberg.

Sections *Ciliata* and *Planifolia* appear closely allied, and were united by Foster in his subsection *Pubescentes* together with *G. pusilla*. They have in common, flowers with very short perianth tubes and bracts that become dry and ferruginous above, during or after flowering. Some species of both sections have flowers with unequal stamens, and puberulous or ciliate stems, the latter found in all four species of section *Planifolia*. The only substantive difference between the sections is that the leaves of section *Planifolia* are flat, and usually smooth, while those of section *Ciliata* have the margins and midribs (and sometimes other veins also) raised and winged, and the edges of the wings ciliate. Two species of section *Planifolia* have zygomorphic and declinate flowers.

Section *Geissorhiza*, which corresponds with Foster's nomenclaturally illegitimate subsection *Ventricosae*, comprises a group of closely related species all having the leaves with strongly thickened margins and veins. In a few species, such

TABLE 3. Important characters in *Geissorhiza* and their primitive and advanced states. The numbers 0 for primitive state, and 1, 2, or 3 for the derived state are used in the cladogram (Fig. 16) to indicate which characters have changed at branch points and their states.

Character Number	Primitive State 0	Advanced State 1, 2, or 3
1. Corm tunics	concentric	1. imbricate
2. Tunic texture	woody, brittle	1. membranous, soft/fibrous
3. Stem	smooth	1. puberulent to pubescent
4. Leaf blade	flat, ensiform	1. linear with thickened margins and midrib 2. linear with winged and ciliate margins and midrib 3. several ribbed and grooved
5. Inflorescence	spike of several flowers	1. solitary flowered
6. Bracts	green and herbaceous	1. very long and outer more or less two times the inner 2. ferrugineous above when plants dried
7. Flower	actinomorphic	1. zygomorphic and declinate
8. Perianth tube	as long as bracts	1. about half as long as bracts or 2. very long and well-exserted (unless the bracts also very long)
9. Stamens and style	well-exserted	1. included in lower part of the tube
10. Filaments	equal	1. one shorter than other two
11. Stem	branched	1. branching suppressed

such a degree that it is best to assign it higher rank than its sister groups rather than follow strict cladistic theory in classifying taxa. The possible intersubgeneric hybrid origin of section *Pusilla* discussed above is not reflected in the cladogram. Instead, section *Pusilla* is placed in subgenus *Weihea* (concentric corm tunics), and the features shared with sections *Geissorhiza* and *Ciliata* emerge as parallelisms.

I have not attempted to develop cladograms for the species in any infrageneric group as there seems little value in such effort in a large genus such as *Geissorhiza* in which there are few significant characters that define species and relationships appear reticulate in many sections due to convergence in many separate characters (homoplasy). In addition, some species that seem distinct on overall morphology appear to have no distinguishing features that can readily be polarized and used in a cladistic analysis.

GEOGRAPHY OF *GEISSORHIZA*

GENERAL TRENDS IN DISTRIBUTION

Geissorhiza is restricted to the southern African winter rainfall region (as defined by Goldblatt, 1976b, 1979a, 1981) which extends along the west coast from southern Namibia to the Cape Peninsula, and along the south coast to Port

Elizabeth (Fig. 17). Only one species, *G. bracteata* occurs significantly outside this area. It ranges from the George district in the southern Cape into the southeastern Karoo and Eastern Cape, where some winter precipitation is usual but the area is usually regarded having a summer rainfall pattern. The genus is largely restricted to the Cape Floristic Province, which lies entirely within the winter rainfall region (Goldblatt, 1978). Only a handful of species occur outside the limits of the Cape Flora, two in the north in Namaqualand and four in the western and winter rainfall part of the Karoo, as well as *G. bracteata*, mentioned above.

The distribution patterns of the two subgenera, *Weihea* and *Geissorhiza*, differ in several ways. The more primitive subgenus *Weihea* is well represented in the southern Cape (Fig. 18), the eastern half of which receives substantial summer precipitation, and is often regarded as a region of year round rainfall. It is here that the majority of the least specialized species occur, most of which have comparatively wide ranges but there are amongst them several local endemics. Three species, comprising section *Tortuosa*, are unusual in this subgenus in being restricted to the western Karoo, where *Geissorhiza* is otherwise represented only by *G. heterostyla* (subgenus *Geissorhiza*). Subgenus *Weihea* has radiated ex-

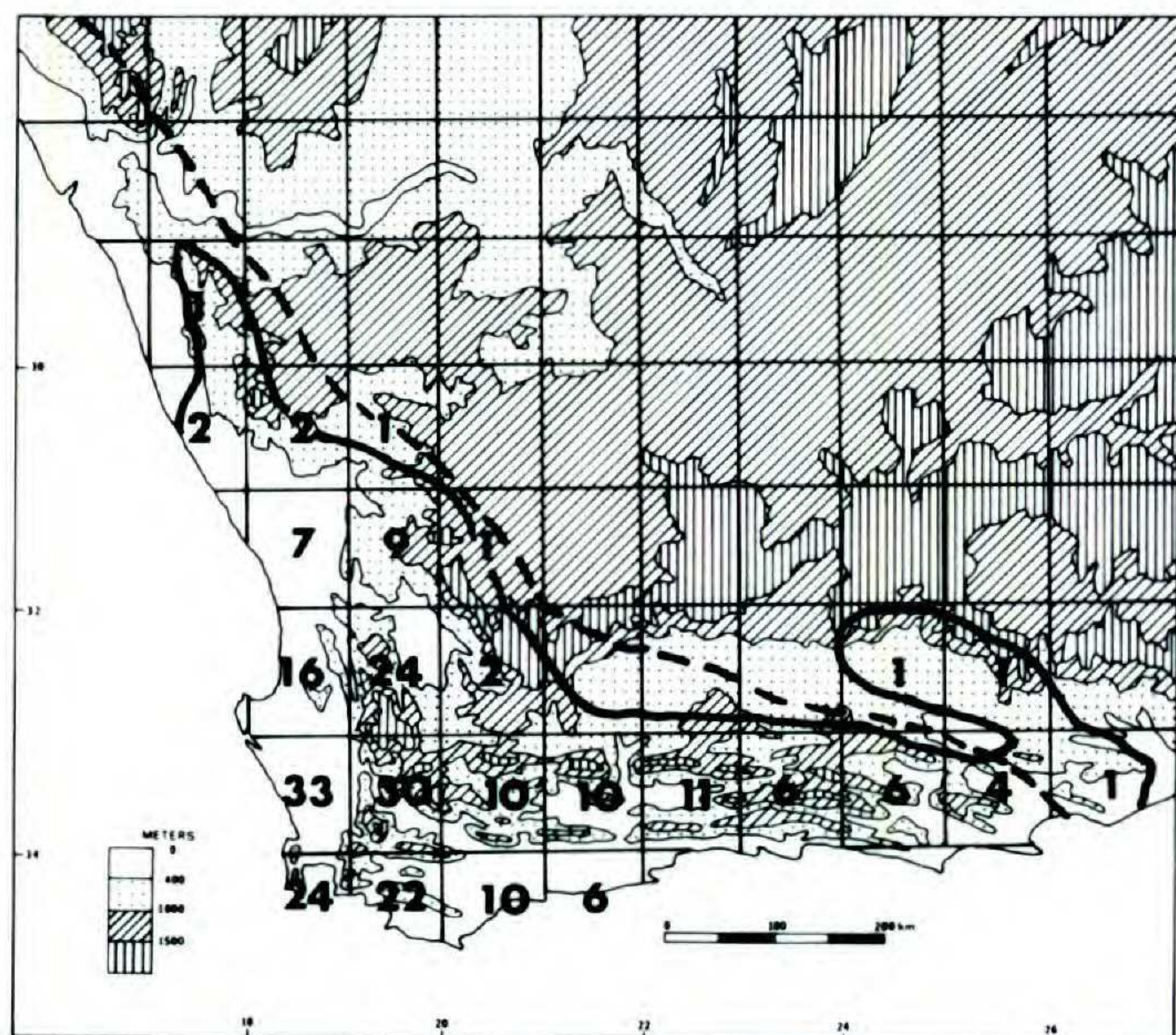


FIGURE 17. Concentration of species of *Geissorhiza* in southern Africa. Numbers indicate the total number of species recorded in each geographical degree square. The entire range of the genus is within the heavy line. The area usually regarded as receiving winter rainfall is to the west and south of the broken line.

tensively in the southwestern Cape, where two sections, *Angustifolia* and *Ixiopsis* have almost all their species. The relatively few species of subgenus *Weihea* that extend further north are amongst the most specialized in the alliance. These include the two species of the peculiar section *Includanthera*, and representatives of sections *Engysiphon* (*G. longifolia*, *G. confusa*, *G. exscapa*) and *Angustifolia* (*G. unifolia*, *G. juncea*).

Subgenus *Geissorhiza* is, in contrast, poorly represented in the southern Cape. It has its center in the southwestern Cape and is well represented northwards through the Cedarberg and Nieuwoudtville Plateau, while two species are endemic in Namaqualand. Despite the different overall distribution patterns in the two subgenera, both exhibit similar modes of extensive radiation in the southwestern Cape, both in the mountains and along the coastal belt from Cape Town to Piketberg. Subgenus *Geissorhiza* has radiated to a greater degree in the mountains of the northwest Cape and has two important centers of endemism here, one in the Cedarberg and one on the Nieuwoudtville Plateau and the Gifberg.

In all, 76 species of *Geissorhiza* occur in the Cape Floristic Region in a strict sense, and of these 73 occur exclusively here. Those occurring in the Cape Region as well as in the Karoo and Namaqualand are: *G. bracteata* (George in the southern Cape to Grahamstown and Cradock);

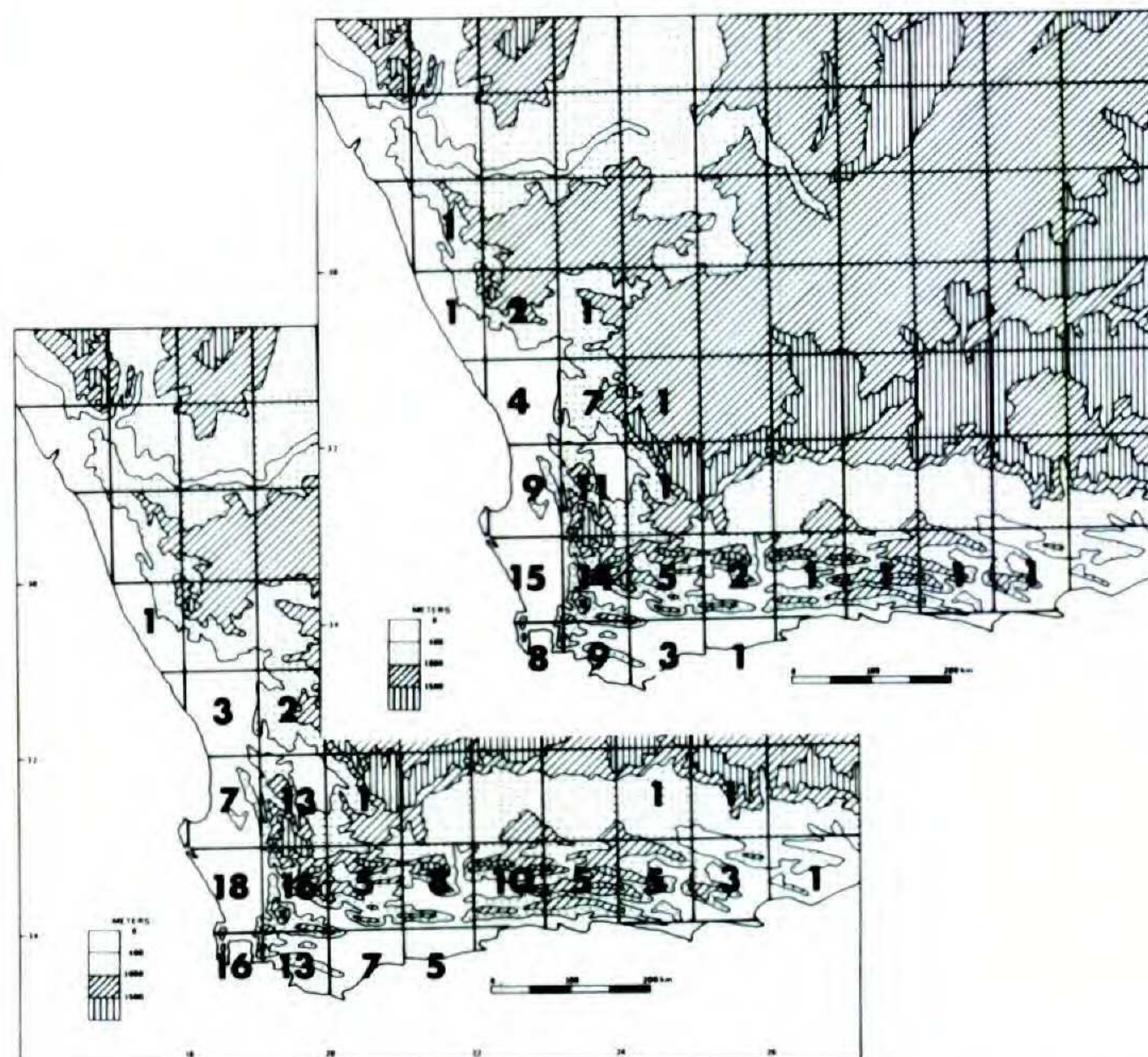


FIGURE 18. Concentration of species in the two subgenera of *Geissorhiza*: above subgenus *Geissorhiza*; below subgenus *Weihea*. Species are centered in the southwestern Cape, but substantial numbers also occur in the southern Cape especially in subgenus *Weihea*, whereas subgenus *Geissorhiza* has radiated extensively along the west coast, with species extending into northern Namaqualand.

G. heterostyla (southern Cape, the western Karoo, Nieuwoudtville escarpment and southern Namaqualand); and *G. exscapa* (Malmesbury to Hondeklipbaai in Namaqualand). *Geissorhiza namaquensis* and *G. kamiesmontana* are restricted to Namaqualand and *G. karooica*, *G. corrugata*, and *G. spiralis* are local endemics in the western Karoo.

The high concentration of species in the west (Fig. 17) suggests that the substantial radiation in *Geissorhiza* in this semi-arid, and summer dry area of rugged and varied landscape has been the result of strong selective pressure through extreme climatic variation during the glacial periods of the later Pleistocene (see chapter on Evolution). Contractions of ranges of species and the reduction and fragmentation of populations during periods of extremely unfavorable conditions presumably enhanced the tendency for divergence of species by the random effects of genetic drift in conjunction with locally differing selective forces. It is not surprising that concentration falls sharply in Namaqualand and in the interior where the climate is most arid. The relatively equable climate and higher, more evenly spread rainfall in the eastern southern Cape has evidently not provided the same stimulus to speciation that is so developed in the west, and this

TABLE 4. Centers of endemism in *Geissorhiza*.

SOUTHWEST CAPE CENTER	
Hottentots Holland-French Hoek Subcenter	<i>G. alticola</i> , <i>G. lithicola</i> , <i>G. nubigena</i>
Malmesbury Flats Subcenter	<i>G. darlingensis</i> , <i>G. eurystigma</i> , <i>G. furva</i> , <i>G. mathewsii</i> , <i>G. purpurascens</i> , <i>G. radians</i>
Cape Peninsula Subcenter	<i>G. bonae-spei</i> , <i>G. tabularis</i>
Bredasdorp Subcenter	<i>G. bryicola</i> , <i>G. schinzii</i>
Species occurring in more than one Subcenter of the Southwestern Center	<i>G. cataractarum</i> , <i>G. hesperanthoides</i> , <i>G. hispidula</i> , <i>G. humilis</i> , <i>G. pusilla</i> , <i>G. setacea</i> , <i>G. tenuis</i>
NORTHWEST CAPE CENTER	
Cedarberg Subcenter (here including the Piketberg)	<i>G. barkerae</i> , <i>G. brevituba</i> , <i>G. cedarmontana</i> , <i>G. ciliatula</i> , <i>G. erubescens</i> , <i>G. leipoldtii</i> , <i>G. louisabolusiaae</i> , <i>G. minuta</i> , <i>G. stenosiphon</i> , <i>G. unifolia</i>
Great Winterhoek Subcenter	<i>G. esterhuyseniae</i> , <i>G. scopulosa</i>
Gifberg-Bokkeveld Mts. Subcenter	<i>G. arenicola</i> , <i>G. divaricata</i> , <i>G. inaequalis</i> , <i>G. splendidissima</i> , <i>G. subrigida</i> , <i>G. sulphurascens</i>
Species occurring in more than one Subcenter of the Northwestern Center	<i>G. longifolia</i>
LANGEBERG CENTER	<i>G. foliosa</i>
KAROO MT. CENTER	<i>G. nigromontana</i>
KNYSNA REGION	<i>G. elsiae</i> , <i>G. outeniquensis</i>
SOUTHEAST CAPE CENTER	none

area may be seen as a refugium for the primitive species of the genus.

CENTERS OF ENDEMISM

Geissorhiza is clearly a genus of the Cape Floristic Region and a predominantly montane one. It exhibits the patterns of endemism that have come to be seen as characteristic of the Cape Region (Weimarck, 1941) and the following discussion is framed in the context of Weimarck's phytogeographical subdivision of the Cape Floristic Region. Weimarck recognized six main centers of endemism and these are dealt with in sequence.

The Southwestern Center. The area of highest species concentration corresponds with Weimarck's Southwestern Cape Center where 46 species occur, 21 of these endemic. Remarkably large numbers of species occur on the coastal plain north of the Cape Peninsula (Weimarck's Malmesbury Flats Subcenter) and on the mountain complex that includes the Kogelberg, Hottentots Holland, French Hoek, Du Toits Kloof, and Bains Kloof Mountain Ranges (the French

Hoek and Hottentots Holland Subcenters). Six species are restricted to the Malmesbury Flats (Table 4) and two to the Hottentots Holland-French Hoek Subcenters. The Cape Peninsula Subcenter is small but has two endemic montane to submontane species (Table 4). These presumably evolved as a result of their separation from the main populations of their relatives that grow inland across the inhospitable Cape Flats barrier that isolates this subcenter. The Bredasdorp Subcenter, so frequently an important center of radiation for taxa of the Cape Flora, has only two endemics (*G. schinzii*, *G. bryicola*), also both montane to submontane. Most of the mountain species of this subcenter also occur in the Hottentots Holland Subcenter, the mountain ranges being continuous or almost so. The lowland species are either shared with the Langeberg Center (*G. nana*) (there is virtually no barrier to migration between the lowlands of the two regions) or the Malmesbury Flats (*G. inflexa*) (isolated by substantial mountain barriers).

The Northwestern Center. This includes two important subcenters, the Great Winterhoek

Subcenter, and the Cedarberg Subcenter (Table 4), while Weimarck admits two noncontiguous areas, the Kamiesberg and Hantam-Roggeveld Subcenters as a part of the Northwestern Center. There are two species restricted to the Great Winterhoek Subcenter and ten to the Cedarberg Subcenter. This area includes several of the most specialized species in the genus including *G. stenosphon*, the two species of section *Includanthera*, *G. esterhuyseniae* and *G. cedarmon-tana*. Evidently the fairly rich development of the Cape flora on Cape Sandstone soils north of the Cedarberg, on the Gifberg and Bokkeveld Mountain complex was unknown to Weimarck, and I feel compelled to extend the Northwestern Center to include this area, which I recognize as the Gifberg-Bokkeveld Subcenter. The significance of this subcenter is particularly evident in Iridaceae, not only in *Geissorhiza* but in several other genera, notably *Hesperantha*, *Gladiolus*, and *Sparaxis* as well as in other monocots. The *Geissorhiza* endemics in this subcenter include *G. subrigida*, *G. divaricata*, *G. arenicola*, and *G. splendidissima*, all closely allied species of section *Ciliata* and *G. sulphurascens*, section *Geissorhiza*.

Neither the Kamiesberg nor the Hantam-Roggeveld Subcenter is regarded today as part of the Cape Flora, but there is a development of vegetation that has several elements clearly of Cape origin. Two species of *Geissorhiza*, *G. tortilis* and *G. corrugata* are endemic in the Hantam-Roggeveld area while *G. heterostyla* is common but it extends through the interior southwestern Cape and the southern Cape to Port Elizabeth. On the Kamiesberg, there are only two species, the endemic *G. kamiesmontana* and *G. namaquensis*, that extend northward to Namaqualand to the southern Richtersveld. Neither species is common, and they seem to be restricted to areas of higher moisture availability in this arid country.

The Southern Cape Centers. Few species of *Geissorhiza* in the southern Cape fall conveniently into the four phytogeographic divisions recognized here by Weimarck (the Karoo Mountain, Langeberg, Knysna, and Eastern Centers). There is only one species, *G. nigromontana*, endemic to the Karoo Mountain Center, one to the Langeberg Center, *G. foliosa*, and two to the Knysna Region, *G. outeniquensis* and *G. elsiae*. No species is endemic to the Eastern Center and its separation from the Knysna Region has no significance for *Geissorhiza* or for Iridaceae in general. In the combined southern Cape Centers, the en-

demics include *G. fourcadei*, *G. roseoalba*, and *G. inconspicua*, in addition to the more restricted *G. foliosa*, *G. outeniquensis*, *G. nigromontana*, and *G. elsiae*. This is not surprising since the Langeberg and Outeniqua Mountains extend virtually continuously from Montagu in the west to Humansdorp in the east, and the few minor gaps seem not to have affected the distribution of *Geissorhiza* species to any degree. The drier interior southern Cape mountains that include the small and somewhat isolated Little Karoo ranges (Rooiberg, Warmwaterberg, Kammanassie Mountains) and the Swartberg Mountains have a poor *Geissorhiza* flora in contrast to the apparently climatically and geologically similar western Cape mountains. Reasons for this are not clear but presumably they had very different climatic histories.

In summary, the southwestern part of the Cape Floristic Region is the center for the evolution and radiation of *Geissorhiza*. Within the region are several important centers of endemism. The most important of these are the coastal plain between Cape Town and Piketberg (Weimarck's Malmesbury Flats Subcenter) and the southwestern Cape mountain complex between Cape Hangklip and Tulbagh (Weimarck's French Hoek and Hottentots Holland Subcenters). The mountains of the west coast, the Northwestern Center, constitute another important center for speciation especially for subgenus *Geissorhiza*; and a Gifberg-Bokkeveld Mountain Subcenter, not recognized by Weimarck, emerges as a major center of endemism in *Geissorhiza* as well as many other geophytic monocots.

ECOLOGY

Species of *Geissorhiza* have radiated extensively in the southwestern Cape and have come to occupy a greater variety of niches than most other genera of Iridaceae, here or elsewhere. Perhaps the most important ecological distinction in the genus is an edaphic one. Species are generally found on either a shale-derived clay soil or a sandstone or granite-derived sandy soil. The importance of soil type in the distribution of Cape taxa (Goldblatt, 1978) has been discussed by several authors for various genera, notably Dahlgren (1968) for *Aspalathus* (Leguminosae) and Rourke (1972) for *Leucadendron* (Proteaceae) and it seems particularly significant in geophytic taxa (Goldblatt, 1976b, 1979a, 1981).

In *Geissorhiza*, which is almost entirely restricted to the area of the Cape Flora, relatively

few species grow on the heavy clay soils that are covered by renosterbosveld, a characteristic microphyllous scrub vegetation. This habitat is shared with numerous geophytic taxa of several families. These soils are found mainly on flats or lower mountain slopes. They are relatively well watered, especially along the coast, in the wet winter months, but dry out rapidly in the later spring when much of the geophyte flora of these areas blooms in a four to six week period in the spring. Common species of this habitat are *G. inflexa*, *G. leipoldtii*, the rare and rather local *G. tulbaghensis* (section *Planifolia*), *G. nana* and *G. bracteata* (section *Weihea*), and *G. ornithogaloides*, to mention some of the more significant examples. *Geissorhiza erubescens* (section *Ciliata*) and *G. longifolia* (section *Engysiphon*) are montane to submontane species, but they occur on the upper shale band of the Table Mountain Series. This is a broad layer of shale located in the upper part of an otherwise sandstone geological system, of which the Cape mountains are largely composed.

The very characteristic nutrient poor quartzitic sandy soils of the Cape region have a quite different range of *Geissorhiza* species, and it is on these soils that most of the radiation in the genus has occurred. The lowland alluvial sands have a very rich *Geissorhiza* flora. These soils also dry out fairly rapidly at the end of the wet months and flowering is condensed into an eight week period, but lasting longer than in the clay-loving species. Most common on flats and lower mountain slopes in sandy soil is *G. aspera*, of the southwestern and western Cape, while *G. heterostyla* is found in similar habitats in the southern Cape. Curiously, outside the Cape Region, *G. heterostyla* occurs on heavy clay soils in the Roggeveld, which seems a strange contradiction. Species of section *Angustifolia* are also well suited to lowland alluvial sands, and *G. humilis* and *G. hispidula* are common here in the western Cape, while the related, very local endemic *G. darlingensis* occurs near Darling in similar sites.

In seasonally moist sites in the southwestern Cape, section *Geissorhiza* has speciated to an unusual extent, and all the species of section *Geissorhiza* occur in such habitats. *Geissorhiza purpureolutea*, *G. imbricata*, and *G. barkerae* occur in moist sandy flats between Cape Town and Piketberg, while *G. brehmii* favors even wetter situations in this area and is semi-aquatic, growing in seasonal pools. In the Darling district where the parent rock is granite, *G. radians*, *G. mathewsii*, and *G. eury stigma*, also of section *Geis-*

sorhiza, fill this seasonally wet lowland habitat. Further north this wet sandy habitat is occupied by *G. louisabolusiae* in the Olifants River Valley and by the closely allied *G. sulphurascens* on the Nieuwoudtville escarpment. Only a few species in other sections grow in this habitat, notably *G. setacea* (section *Weihea*) which occurs between Cape Town and Gouda.

The characteristically montane species all grow in well-drained, nutrient poor soil derived from rocks of the Cape Sandstone series. Although these soils are very low in nutrients and have poor water retaining properties, the mountains themselves receive a higher rainfall than the surrounding valleys and flats, and this appears to have allowed geophytic groups such as *Geissorhiza* to have filled some unusual niches. In montane marshy sites, *G. umbrosa* is often common in the early summer when the surrounding vegetation has been burned. Damp southerly facing slopes often harbor *G. hesperanthoides*, *G. nubigena*, and open rocky situations are a habitat for *G. ramosa*, *G. grandiflora*, and *G. burchellii*. The flowering season is later and longer in the higher mountains, presumably because of cooler temperatures and because moisture may be available for a longer time, or may even be permanent, as for the January flowering *G. cataractarum* and *G. outeniquensis*, both species of stream and waterfall edges.

Species of section *Engysiphon* often occur on dry mountain slopes and flower in the early summer. In the Caledon district, the section is represented by *G. schinzii*, *G. confusa* occurs in the mountains to the north while *G. brevityba* is restricted to the isolated Piketberg Mountains and *G. bonae-spei* to the southern Cape Peninsula.

POLLINATION

The pollination biology of *Geissorhiza* is largely unknown, but the genus is believed to be mainly bee pollinated (Vogel, 1954: 101, 115). Vogel suggested this on the basis of the predominant flower form in the genus: the flowers are radially symmetric, typically short-tubed, open during the day, and are brightly colored, often violet to purple. He cites only a few direct observations to support his hypothesis, including those of Elliot (1891), who made numerous records of insect visitors on southern African plants. Elliot found that *Geissorhiza aspera* (as *G. secunda*) was visited by several species of bees. His record of a dipteran visiting '*Ixia excisa* Thunb.' is also probably for *Geissorhiza*, *I. excisa* being an early synonym for the distinctive *G. ovata*. Vogel re-

cords the observations of Hans Herre of bee pollination for *G. radians* (as *G. rochensis*) and presumably his own for a few more species: *G. splendidissima*, *G. furva*, and a species identified as *G. ramosa*, all from 'Little Namaqualand,' probably the northwestern Cape.

Vogel suggests that the pale, small flowers of *G. juncea* are moth pollinated, on the assumption that they open in the evening. The species is, however, day blooming and very short-tubed therefore, moth pollination is unlikely. If direct observation was actually involved, then a misidentification must have been made. Vogel also suggests that the few long-tubed species of *Geissorhiza* may be butterfly pollinated, mentioning by name *G. fourcadei*. On the basis of their flower form, he predicts that *G. ovata* and '*G. namaquensis*,' perhaps *G. kamiesmontana*, also have this type of pollination. Elliot's observation of a dipteran visiting *G. ovata* would seem to contradict butterfly pollination for this species.

Clearly more data is required before the somewhat confusing and uncritical suggestions made by Vogel can be accepted. It seems likely that pollination studies in *Geissorhiza* will be of considerable value in understanding the evolution and speciation in this large genus in which flower form is often the major or only distinction between related species.

CONSERVATION

There are a large number of very localized species in *Geissorhiza* and by certain definitions all of these may be regarded as potentially endangered. However, all of those that occur in mountain habitats appear reasonably secure because this habitat is not likely to be modified to any appreciable degree in the foreseeable future except by too frequent fires and the spread of alien woody vegetation that poses a severe threat to some of the Cape mountain vegetation (Goldblatt, 1978; Stirton, 1978). As far as I am aware, there are at this time no mountain species of *Geissorhiza* that are in any way endangered. The current practices of conservation and management conducted by the South African Department of Forestry, which controls a large part of the Cape mountains, is in fact likely to improve the conservation status of what remains of this vegetation.

The situation is, however, very different in the lowlands, particularly on the coastal plain north of Cape Town as far as Piketberg. Here the spread of agriculture and the growing population are placing considerable pressure on what little re-

mains of the rich and highly endemic flora of the area. This coastal plain is one of the two major centers of radiation of *Geissorhiza* and of the approximately 35 species that occur here, 15 have the larger part of their range in this relatively small area, and six species, *G. purpurascens*, *G. darlingensis*, *G. eurystigma*, *G. mathewsii*, *G. furva*, and *G. radians* are endemic. A further two at least, *G. setacea* and *G. purpureolutea*, are nearly restricted to this area and are similarly threatened. Of the species mentioned above by name, only *G. radians* (better known as *G. rochensis*) has a wide distribution throughout the coastal plain. Although now reduced to fewer and smaller populations, it is still relatively common. The exact status of the other species mentioned is uncertain but all must be regarded as severely threatened in some degree. *Geissorhiza darlingensis* and *G. mathewsii*, are both restricted to few sights and require protection. Both occur in the Darling area, northwest of Cape Town in a rich agricultural region, and the changes in agricultural practice in recent years including aerial spraying of weed killers and insecticides, as well as the enrichment of the soil through annual application of fertilizers, have changed the habitat of what is left of the native flora so that it seems probable that some of the rarer coastal plain endemics may become extinct within the next few decades through habitat loss or impoverishment. As demonstrated by Parker (1982), there is very little undisturbed habitat along the west coast and the need for preserves to save what remains of this once rich and interesting flora should be given the highest priority.

To the north, the situation is similar in lowland areas and *Geissorhiza lousabolusiae*, endemic to the mid Olifants River Valley and adjacent valleys, is near extinction as a result of the spread of agriculture in this area and the draining of the semi-marshy situations to which it is restricted. The several local endemics of the Nieuwoudtville escarpment have always been very local in range and should be considered under pressure. Flat sandy areas here are increasingly being put to agricultural use and the striking *G. splendidissima*, to name one species, is becoming particularly rare and should be regarded as seriously endangered.

EVOLUTION

It seems likely that the ancestral stock that gave rise to *Geissorhiza* and the closely allied *Hesperantha* differentiated in upland eastern

southern Africa in the Miocene (26–5 Ma) when the climate of this area was becoming increasingly seasonal and the predominant forest vegetation was giving place to larger areas of open grassland and heathland (Axelrod & Raven, 1978; Goldblatt, 1983). A seasonal climate presumably provided the selective force for the deciduous and geophytic habit. During the Miocene, Africa moved rapidly some 10° northwards and at this time the southern and western Cape must have been well forested perhaps with local areas of drier climate suitable for geophytes.

Conditions along the wetter parts of the southern Cape coast today are probably similar with forest clothing the valleys and the southern mountain slopes but locally either rock outcrops, shallow soils or rainshadow effects provide suitable habitats for species of *Geissorhiza* and many other geophytic taxa. It was not until the late Pliocene or the Pleistocene, however, that a Mediterranean, winter wet and summer dry, climate developed along the Cape southwestern and west coasts and truly arid conditions prevailed to the interior and further north along the west coast. Thus the large numbers of species of *Geissorhiza* that occur today in the southwestern Cape and seem so specialized in comparison to most of the species of the southern Cape, probably did not exist until relatively recent times. Many probably evolved only during the Pleistocene as the distinctive Cape climate became established. The climatic fluctuations of the Pleistocene, reasonably well documented along the Cape west coast at Rietvlei and Langebaan, are believed to have provided the stimulus for the burst of radiation that produced the wide array of species of *Geissorhiza* in the southwestern Cape.

The unspecialized southern Cape species such as *Geissorhiza inconspicua*, *G. bracteata*, and *G. foliosa* have probably diverged very little from their ancestors that were present in the late Miocene and the Pliocene. They probably evolved slowly by a process of phyletic evolution (G. G. Simpson, 1953; B. B. Simpson, 1973) rather than true speciation. These species or their ancestors probably migrated from the forests of southeastern Africa into the eastern and southern Cape when habitats opened up for them as aridity spread southward in the Pliocene and Pleistocene and the southern forests began to shrink.

The establishment of a Mediterranean climate in the extreme southwestern Cape during the Pleistocene and the recorded climatic fluctua-

tions of the time are known to have led to major shifts in the vegetation belts here, with the forest alternately contracting to sheltered sites and then expanding into the lowlands where they do not occur today. These shifts must have affected the ranges and population sizes of species of *Geissorhiza* very strongly, with the resulting local extinctions and fragmentation of populations that are believed to precede geographic speciation. Increasing aridity also accentuated habitat differences and increased the diversity of ecological niches available to species.

The large numbers of species that occur along the west coast and in the adjacent mountains are thus seen as having evolved under circumstances of increasing but fluctuating aridity, more or less in place in a relatively short time, following the classical model for geographic and ecological speciation or a combination of these. The main trends of phenotypic specialization are xeromorphic. They include a reduction in the number of leaves, decrease in leaf surface area, the development of heavy marginal and costal thickenings alternating with grooves, and leaf edge ciliation. Stem modifications include the development of pubescence, the reduction of branching and of flower number in the spike. Similarly, floral modifications such as the decrease or increase in the tube length are associated with specialization for different pollinators, a feature not evident among the primitive, less drought adapted species. Such floral specializations seem consistent with adaptation to drier climates, where bees and other insects with specialized pollination behavior are more numerous.

Subsequent migration and the spread of newly evolved forms must certainly have occurred but time and physical barriers have limited their spread throughout suitable areas of the southwestern Cape, and these factors have combined to produce the patterns of distribution that prevail today. The centers of endemism and geography of the genus are discussed more fully in the section on Geography.

Section *Includanthera* affords a striking example of quantum evolution or speciation (G. G. Simpson, 1953; Grant, 1977), usually regarded as distinct from geographic speciation. In quantum speciation, novel phenotypes appear to have been produced abruptly, without a series of intermediates among their allies. The two species of section *Includanthera* are remarkable in their long-tubed flower with the stamens in-

cluded in the middle part of the tube and the style and style branches more or less rudimentary and no more than a few millimeters long. The species with this remarkable flower might seem better treated as a separate genus but examples of similar specialization occur in a few isolated species of *Hesperantha* (Goldblatt, 1984) and in some forms of *Ixia paniculata* (Lewis, 1962). The examples of convergence for included stamens and styles makes it seem best to maintain species with this character combination in the genera to which they are allied.

Speciation through gross chromosome mutation is apparently rare in *Geissorhiza*. Examples of polyploid speciation include *G. inaequalis* and possibly *G. bracteata*, both tetraploid, but the single count for the latter is not sufficient for this hypothesis to be accepted without reservation. In *G. aspera* where tetraploid populations were initially found, further examination has revealed the presence of diploid populations as well, and the possibility of its polyploid origin is no longer tenable. *Geissorhiza bolusii*, however, seems to have arisen through allopolyploid hybridization. The five populations counted are all triploid, $2n = 39$. The ancestors of this widespread, sexually sterile species have not been identified, but the morphologically similar and sexually fertile *G. ovalifolia* (chromosome number unknown) is very likely one of the progenitors of *G. bolusii*.

With about half the species of *Geissorhiza* known cytologically, it is not possible to fully assess the role of chromosomal mutation in speciation, but it seems likely to have been small as in most other genera of Ixioidae in Africa (Goldblatt, 1971), with the notable exception of *Romulea* (De Vos, 1972).

TAXONOMIC HISTORY

The first species of *Geissorhiza* known to science were described during the later eighteenth century, and assigned to the broadly circumscribed genus *Ixia*. When *Geissorhiza* was first regarded as distinct from *Ixia* (Ker, 1803, 1804) some 15 different species had been described, three by de la Roche (1766), one each by Bergius (1767), Burman f. (1768), and Linnaeus f. (1782), eight by Thunberg (1783, 1800, 1803) and two by Ker. Ker actually admitted only 11 species to *Geissorhiza* (one of which is *Romulea* sp. and another a nomen nudum but it is probably the species currently known as *G. furva* Ker ex Baker). He was apparently unaware of Burman's *G.*

ovata, of which *G. excisa* (L. f.) Ker is a synonym, and of three Thunberg species, *G. exscapus* published in 1800 (as *Gladiolus*) and *G. monanthos* and *G. radians* published in early 1803.

Of these early botanists, the contribution made by Thunberg is by far the most important (Goldblatt, 1983). Thunberg actually collected specimens of at least 13 species during the three years he spent exploring the Cape (1772–1775). He regarded these as belonging to eight different species, seven assigned to *Ixia* and one, *G. exscapus* to *Gladiolus*. Thunberg treated all but two, *I. secunda* sensu Berg. and *I. hirta* Thunb. (nom. superfl. pro *I. inflexa* de la Roche) as new. The identity and typification of the species described by Thunberg is complex and although the Iridaceae of Thunberg's Herbarium were examined and reviewed by Brown in 1928, several problems were only resolved after a recent reexamination of the collection (Goldblatt, 1983). The typification of the three species of *Ixia* described by Daniel de la Roche and now known to belong in *Geissorhiza* is also problematic (Goldblatt & Barnard, 1970). Authentic material was discovered in 1969 and as a result several de la Roche species could for the first time be identified and typified, including the long misinterpreted *G. (Ixia) inflexa*. No authentic material of *G. (Ixia) imbricata* was discovered and a neotype now identifies this species (Goldblatt & Barnard, 1970). The name of a third species, *I. secunda* (syn. *G. eurystigma*) cannot be transferred to *Geissorhiza* as the epithet is occupied in the genus.

The important cycle of collecting in the period 1820–1830, by Ecklon and Zeyher, by Drège, and to a lesser extent by Pappe, resulted in the discovery of many more new species of *Geissorhiza*, collected in large sets and widely distributed among European, North American, and South African herbaria. Ecklon (1827) enumerated his and Zeyher's collections, several of these being new species, but mostly as nomina nuda. Ecklon also introduced the new generic name *Weihea* (also without description) for the unusual *G. ovata* (as *W. excisa*) as well as *G. bracteata* (as *W. elatior*). *Weihea* was validated as a subgenus by Foster (1941) and is recognized here with a much broader circumscription. Amongst Ecklon's 18 listed species of *Geissorhiza* and *Weihea*, 13 are apparently new, but only two, *G. rosea* and *G. candida* can be regarded as legitimate. Most of the Drège, and Ecklon and Zeyher collections were

studied later in the nineteenth century by Klatt (1866, 1882) and by Baker (1876, 1892, 1896), both of whom described several new species from their collections.

Baker's treatments of Iridaceae in his "Handbook of the Irideae" (1892) and in "Flora Capensis" (1896), essentially identical, are a watershed for the taxonomy of the family in southern Africa. Baker recognized 29 species in *Geissorhiza* (six of which have since been transferred to *Hesperantha*, *Ixia*, and *Gladiolus*) and three more were assigned either to *Acidanthera* (*G. exscapa* as *A. tubulosa*; and *G. tenella* as *A. rosea*) or *Romulea* (*G. spiralis*). Klatt's (1895) treatment in the "Conspectus Florae Africae" is seldom given much attention by systematists, but it is noteworthy that he recognized 40 species in *Geissorhiza*. Of these some five belong to other genera, leaving the genus still appreciably larger than Baker treated it a year later.

Botanical activity in southern Africa accelerated in the late nineteenth century, when important collections of *Geissorhiza* were made by Peter MacOwan, Harry Bolus, Arnold Penther, and notably Rudolph Schlechter. Baker described three species based on Penther collections that he saw after the "Flora Capensis" had been published. Schlechter's collections were described partly by Schlechter himself (1899), but only one of his species, *G. hesperanthoides*, is currently recognized. Later, Foster (1941) described several new species based on the Schlechter collections, of which *G. burchellii*, *G. malmesburiensis*, and *G. leipoldtii* are currently recognized.

The modern cycle of collecting, initiated by H. M. L. (Louisa) Bolus in the 1920s continued essentially without a break until today. Louisa Bolus and her students, W. F. Barker and G. J. Lewis, as well as R. H. Compton made important collections of Iridaceae generally. Their activity resulted in the discovery of several new species of *Geissorhiza* (Bolus, 1930, 1931; Bolus & Lewis, 1933) and extended the known ranges of many more. Foster's studies, published at this time, however, benefited little from this work, and he saw only the few duplicates that then reached European herbaria. Nevertheless, Foster (1936, 1941) clarified the nomenclature of several previously problematic species, and he described as new some 11 species: *G. burchellii*, *G. louisa-bolusiae*, *G. sulphurascens*, *G. leipoldtii*, *G. ovalifolia*, *G. malmesburiensis*, currently recognized and *G. marlothii*, *G. rubicunda*, *G. ixioides*, *G.*

lewisiae, *G. montana*, here reduced to synonymy.

During this time the artificially constituted genus *Acidanthera* was largely disassembled by Lewis (1941). Species were shown to belong to *Gladiolus*, *Hesperantha*, *Tritonia*, and *Geissorhiza* while a few, regarded by Lewis as allied to *Geissorhiza*, were assigned to a new genus *Engysiphon*. The criteria she used for distinguishing this genus from *Geissorhiza* are: unilateral and declinate stamens and style; filaments exceeding anthers; bracts firm throughout; and a long flower, usually with a well-developed perianth tube. Critical analysis shows that *Engysiphon* has no significant characters or character combinations not found in *Geissorhiza*. The genus is reduced to sectional subgeneric rank here.

The extensive botanical exploration of the higher Cape mountains, undertaken by Elsie Esterhuysen, began in the 1940s. Esterhuysen's Cape mountain collections, supplemented by those of Thomas Stokoe, Peter Jackson, and Ernest Galpin have brought to light a whole range of montane species of *Geissorhiza* and expanded the ranges of several more. As a result, *G. alticola*, *G. nubigena*, *G. esterhuyseniae*, *G. stenosphon*, *G. scopulosa*, *G. unifolia*, *G. elsiae*, and *G. grandiflora*, previously unknown or poorly collected, were discovered and are described here, while species such as *G. burchellii* and *G. ramosa* previously known only from one or a few gatherings from isolated mountain localities are now known to have extensive ranges. The high mountain species are still relatively poorly known, and it seems likely that novelties will continue to be discovered in the mountains of the western and southern Cape.

SYSTEMATIC TREATMENT

Geissorhiza Ker, Ann. Bot. (König & Sims) 1: 223. 1804; Baker, Handb. Irid. 152–159. 1802, Fl. Cap. 6: 65–76. 1896; Klatt, Abh. Naturf. Ges. Halle 15: 390–393 (Erg. 56–61). 1882; Durand & Schinz, Consp. Fl. Afric. 5: 176–181. 1895; Foster, Contr. Gray Herb. 135: 3–78. 1941; Lewis, Fl. Cape Pens. 252–256. 1950. TYPE: *G. obtusata* Ker [= *G. imbricata* subsp. *bicolor* (Thunb.) Goldbl.].

Ixia L. sensu L. f., Suppl. Pl. 91–94. 1782; sensu Thunb., Diss. de *Ixia* 1783, pro parte.

Weihea Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 22. 1827, nom. nud.

Sphaerospora Klatt, Linnaea 32: 725. 1863, hom. illeg.

non Sweet ex Loudon (1841). TYPE: *S. exscapa* (Thunb.) Klatt (lectotype here designated).

Acidanthera Hochst. sensu Baker, Fl. Cap. 6: 130–134. 1896, pro parte.

Engysiphon Lewis, J. S. African Bot. 7: 19–24. 1941. TYPE: *E. schinzii* (Baker) Lewis (lectotype here designated, type not indicated by Lewis).

Plants small to medium in size. *Rootstock* a tunicate corm, with hard and woody to membranous, or rarely fibrous coverings, either asymmetric with one side flattened below and sometimes extending downwards shortly or evidently symmetric, but usually with the roots developing from a small ridge on one side; *tunics* either concentric (subgenus *Weihea*) with the outer layers usually light brown and completely enclosing the inner, fragmenting into irregular to elliptic segments, often drawn into points above and below; or imbricate (subgenus *Geissorhiza*) with the outer layers dark brown to blackish and covering the inner above only, regularly V-notched below into nearly rectangular segments. *Leaves* several to only 2 (rarely solitary), at least the lowermost basal and usually largest, decreasing in size above and the uppermost often becoming bract-like and entirely sheathing, erect to falcate or sometimes prostrate, linear, ensiform or linear; surface plane and smooth (rarely pubescent, *G. pusilla*), or with the margins and midrib raised and thus 2-grooved on each surface, sometimes (section *Ciliata*) the margins held at right angles to the blade and ciliate along the edges and the midrib (and occasionally other veins) raised and winged, with cilia along the edges, or lamina 3 to several ribbed and grooved (section *Geissorhiza*); margins smooth, ciliate to pubescent, or sticky and with adhering soil. *Stem* erect, terete, simple or branched and then either from the base or from cauline nodes. *Spike* usually several to many flowered, or sometimes only 1- or 2-flowered; always drooping in bud and becoming erect as the flowers open; *bracts* herbaceous to membranous, sometimes reddish on the upper margins, dry and brownish in the upper half (especially

sections *Planifolia* and *Ciliata*), the outer larger and usually slightly longer than the inner, the inner bifid at the apex. *Flower* actinomorphic and stellate to hypocrateriform or zygomorphic with decumbent, declinate filaments and upright, unilateral anthers and a declinate style, variously colored with shades of purple and pink, or deep violet to blue most common, but also red, white, or yellow, the tepals often darker colored on the reverse and frequently reddish when flowers a pale color; *perianth tube* straight, shorter or about as long as the bracts, less often much longer than the bracts, usually cylindric; *tepals* oblong to obovate, the outer usually somewhat larger than the inner, spreading equally or with the posterior tepals upright and the anterior tepals horizontal and lying below the decumbent stamens and style. *Filaments* inserted near the top of the perianth tube, occasionally in lower part of the tube, erect and symmetrically disposed to unilateral and declinate, all equal or one consistently shorter than the other two (especially subgenus *Geissorhiza*); *anthers* oblong to linear, shortly tailed, subbasifixed, extrorse when symmetrically disposed, well-exserted (included in section *Includanthera*), pollen yellow, blue, or violet. *Ovary* ovoid, style slender, initially erect, usually becoming displaced laterally or declinate and lying under the filaments, usually well-exserted and branching near the apex of the anthers, occasionally entirely included (section *Includanthera*), sometimes dividing at the mouth of the tube or at the base of the anthers, style branches usually short, ascending and ultimately recurved, occasionally flat and broadly lobed. *Fruit* a globose to obovoid capsule, usually about as long as the bracts; seeds globose to angular, light to dark brown. *Basic chromosome number*, $x = 13$.

Eighty-one species, restricted to the winter rainfall areas of southern Africa, and concentrated in the southwestern Cape; one species extending into northern Namaqualand and another into the eastern Karoo and Eastern Cape as far east as Cradock and Grahamstown.

- 1a. Stamens and style entirely included in perianth, not visible without opening the tube.
 - 2a. Leaves plane, 3–5 mm wide; flowers white 23. *G. esterhuyseniae*
 - 2b. Leaves with margins and midrib heavily thickened, 1.5–2 mm wide; flowers pale pink with darker markings at base of tepals 24. *G. cedar montana*
- 1b. Stamens and style (or at least style branches) fully exerted from perianth tube.
 - 3a. Leaf solitary, sheathing below, and with a membranous sheathing bract in upper part of stem 32. *G. unifolia*
 - 3b. Leaves two or more in addition to any entirely sheathing membranous to submembranous bracts in upper part of stem.
 - 4a. Leaves spirally twisted and flowering stems single flowered.
 - 5a. Flowers yellow with perianth tube to 3 mm long 19. *G. corrugata*
 - 5b. Flowers purple with perianth tube 4–5 mm long 20. *G. spiralis*
 - 4b. Leaves erect to falcate, not spirally twisted and flowering stems 2–several (rarely 1-flowered).
 - 6a. Stem minutely ciliate, puberulent or pilose, partly or throughout.
 - 7a. Stamens unequal, one at least 0.5 mm, but usually more than 1.5 mm shorter than the other two.
 - 8a. Leaf more or less plane (margin and midrib sometimes slightly thickened).
 - 9a. Stamens unilateral and declinate; flower large 70. *G. monanthos*
 - 9b. Stamens symmetrically disposed.
 - 10a. One filament slightly shorter (less than 2 mm), tepals 11–16 mm long 68. *G. aspera*
 - 10b. One filament at least 4 mm shorter than other two, tepals 18–23 mm long 69. *G. inaequalis*
 - 8b. Leaf with margins and midrib raised significantly.
 - 11a. Plant with 3 leaves and a small sheathing membranous bract in upper third whether branched or not from this point.
 - 12a. Tepals 8–9 mm long; anthers 2–2.5 mm long 65. *G. scopulosa*
 - 12b. Tepals 10–22 mm long; anthers 4–6 mm long 76. *G. heterostyla*
 - 11b. Plant with 3 leaves but without a stem bract, whether branched or not.
 - 13a. Leaves conspicuously ciliate-pubescent on the edges of the margins and midrib 81. *G. leipoldtii*
 - 13b. Leaves smooth or minutely ciliate along margins or midrib 77. *G. arenicola*
- 7b. Stamens equal.
 - 14a. Leaf plane.
 - 15a. Tepals 14–22 mm long; stamens usually unilateral and declinate.
 - 16a. Flower dark blue, sometimes red or pale in center 70. *G. monanthos*
 - 16b. Flower white, marked red to brown in center 71. *G. tulbaghensis*
 - 15b. Tepals 9–15 mm long; stamens symmetrically disposed 68. *G. aspera*
 - 14b. Leaf not plane, margins and midrib significantly raised.
 - 17a. Margins extended at right angles to lamina and hispid to ciliate along edges; midrib and sometimes other veins also hispid to ciliate.
 - 18a. Perianth tube short, to 4 mm long.
 - 19a. Flower small, tepals 8–12 mm long; anthers 2.5–3 mm long 80. *G. erubescens*
 - 19b. Flower medium to large, tepals (13–)15–28 mm long; anthers (3–)6–8 mm long.
 - 20a. Flower deep violet blue; stamens declinate; anthers brown 78. *G. splendidissima*
 - 20b. Flower white to pale purple; stamens symmetrically disposed; anthers yellow 81. *G. leipoldtii*
 - 18b. Perianth tube long, at least 6 mm and to 25 mm long.
 - 21a. Perianth tube about as long as the bracts, 6–8(–11) mm long 72. *G. namaquensis*
 - 21b. Perianth tube much longer than bracts, 18–25 mm long 73. *G. kamiesmontana*
 - 17b. Margins and other veins not hispid or ciliate.
 - 22a. Flower small, tepals 6–7 mm long; leaf to 1 mm wide 66. *G. ciliatula*
 - 22b. Flower medium-sized, tepals 7–10 mm long; leaf 1.5–3.5 mm wide 31. *G. intermedia*

- 6b. Stem smooth.
- 23a. Stamens unequal, one at least 0.5 mm and usually more than 2 mm shorter than other two. 76. *G. heterostyla*
- 24a. Leaf margins winged and ciliate to hispid along the edges
- 24b. Leaf margins either not winged, or if thickened to winged then not ciliate to hispid along the edges.
- 25a. Flower small, tepals 8–11 mm long.
- 26a. Stem erect, 2–3-branched (rarely simple); spike with up to 11 flowers; leaves with thickened margins and midribs; flowers usually purple to violet 63. *G. ramosa*
- 26b. Stem usually inclined to trailing, occasionally with 1(–2) branches; spike usually 2–6-flowered; leaves flat or nearly so; flowers white 64. *G. bryicola*
- 25b. Flower medium to large, tepals (12–)14–30 mm long.
- 27a. Flower cream to yellow, with or without dark markings in the center.
- 28a. Leaf few ribbed and grooved, or leaf nearly terete with narrow longitudinal grooves; flower yellow throughout 53. *G. louisabolusiae*
- 28b. Leaf several ribbed and grooved; flower yellow with dark markings in the throat 52. *G. barkerae*
- 27b. Flower shades of blue, purple, or pink (rarely white).
- 29a. Perianth tube short, 2–3 mm long 62. *G. tabularis*
- 29b. Perianth tube at least 4 mm and to 22 mm long.
- 30a. Leaves plane 67. *G. pseudinaequalis*
- 30b. Leaf margins and midribs thickened.
- 31a. Tube 4–6 mm long 60. *G. burchellii*
- 31b. Tube 10–22 mm long 61. *G. grandiflora*
- 23b. Stamens equal.
- 32a. Leaves more or less plane (margins and midrib sometimes slightly thickened).
- 33a. Flower zygomorphic with stamens unilateral and declinate.
- 34a. Flower pink, large, tepals 22–32 mm long.
- 35a. Corm tunics soft textured, decaying readily; plants unbranched and trailing; perianth tube 10–13 mm long 4. *G. oueniquensis*
- 35b. Corm tunics hard and woody, persistent; plants sometimes branched and erect; perianth tube 8–10 mm long 3. *G. roseoalba*
- 34b. Flower purple, medium in size, tepals 12–15 mm long 21. *G. karooica*
- 33b. Flower actinomorphic with stamens symmetrically disposed.
- 36a. Leaves linear to ensiform, narrow, 1–2(–3) mm wide, and never pubescent; stems 1–2-flowered.
- 37a. Perianth tube 6–8 mm long, typically exerted from the bracts; flowers white to cream, rarely pale yellow.
- 38a. Plants usually dichotomously branched, more than 12 cm high 14. *G. geminata*
- 38b. Plants rarely branched but if so then not dichotomously, 4–8 cm high 11. *G. setacea*
- 37b. Perianth tube 2–5 mm long; flowers white, yellow (often fading to greyish black), or pale lilac.
- 39a. Flowers in shades of yellow.
- 40a. Flowers stellate, with tepals 6–12(–18) mm long; perianth tube 2–3 mm long 12. *G. ornithogalooides*
- 40b. Flowers cupped, with tepals 13–25 mm long; perianth tube 4 mm long 13. *G. malmesburiensis*
- 39b. Flowers white or lilac.
- 41a. Perianth tube 3–5 mm long 9. *G. bracteata*
- 41b. Perianth tube 1–3 mm long.
- 42a. Tepals 3–6 mm long, tube 1–2.5 mm long 10. *G. nana*
- 42b. Tepals 6–12 mm long; tube 2–3 mm long 8. *G. delicatula*
- 36b. Leaves ovate, ensiform or lanceolate, (2–)3–10 mm wide, smooth or pubescent; stems (1–)3–10-flowered.
- 43a. Lower leaves prostrate or inclined towards the ground.

- 44a. Flower large, tube 10–18(–30) mm long, as long or longer than the tepals 7–13 mm 18. *G. ovata*
 44b. Flower small to medium in size, tube to 8 mm long, shorter than the tepals.
 45a. Spikes all single flowered; flowers pale lilac 8. *G. delicatula*
 45b. Spikes typically bearing more than a single flower; flowers white, cream, or pale yellow.
 46a. Plants with cormlets produced in the axils of one or more leaves; leaves flaccid, usually more than 2 cm.
 47a. Stem usually without or with only one cauline leaf or bract; flowers fertile and capsules developing rapidly after blooming 15. *G. ovalifolia*
 47b. Stem usually with 2 to several cauline leaves or bracts, all bearing axillary cormlets; flowers sterile and cormlets produced in place of capsules after flowering 16. *G. bolusii*
 46b. Plants without cormlets in the leaf axils; leaves firm, 1.5–2(–4.5) cm long 17. *G. parva*
 43b. All leaves erect to falcate.
 48a. Perianth tube less than 3 mm long; flowers in shades of blue and purple.
 49a. Leaves pubescent, at least below; bracts dry and brown in the upper half 22. *G. pusilla*
 49b. Leaves smooth entirely; bracts not dry and brown in the upper half 7. *G. nigromontana*
 48b. Perianth tube 3–6 mm long; flowers white or blue to purple.
 50a. Perianth tube more than 7 mm long 2. *G. elisiae*
 50b. Perianth tube 2–6 mm long.
 51a. Spike typically 3–7-flowered; perianth tube 4–6 mm long.
 52a. Leaves 5 to several, lanceolate, less than a third of the length of the stem; tepals 13–17 mm long 6. *G. foliosa*
 52b. Leaves 3–5, ensiform to linear, one to two-thirds the length of the stem; tepals 8–11(–15) mm long 1. *G. inconspicua*
 51b. Spike typically 1(–3)-flowered; perianth tube 3–5 mm long 9. *G. bracteata*
 32b. Leaves not plane, either terete or nearly so, or margins and or other veins thickened or raised significantly.
 53a. Outer floral bracts 15–65 mm long and the inner bracts about half as long as the outer.
 54a. Leaves linear to terete, with the margins having raised wings curving over the inconspicuous midrib.
 55a. Tepals nearly linear, acute and 3–4.5 mm wide 46. *G. tenella*
 55b. Tepals lanceolate to obovate, acute to obtuse and 4.5–11 mm wide.
 56a. Perianth tube 15–30 mm long 45. *G. bonae-spei*
 56b. Perianth tube 40–80 mm long 47. *G. exscapa*
 54b. Leaves ensiform to linear or falcate, with the margins and midrib strongly thickened, the blade thus appearing broadly 2-grooved on each surface.
 57a. Tepals 17–27 mm long, white or flushed with pink 43. *G. longifolia*
 57b. Tepals 28–40 mm long, pink or ivory yellow.
 58a. Tepals usually longer than the tube, and 9–15 mm wide 42. *G. schinzii*
 58b. Tepals shorter than the tube, and 7–10 mm wide 44. *G. confusa*
 53b. Outer floral bracts 6–20(–25) mm long, and the inner bracts about as long, or only slightly shorter (at least two-thirds as long as outer).
 59a. Leaves terete or nearly so, narrowly 4–(5–6)-grooved in section.
 60a. Sheath of upper leaf conspicuously inflated and several ribbed and grooved.
 61a. Perianth tube 3–4.5 mm long.
 62a. Flower deep yellow, campanulate 53. *G. louisabolusiae*
 62b. Flower creamy white, stellate 55. *G. sulphurascens*
 61b. Perianth tube 5–9 mm long 54. *G. brehmii*
 60b. Sheath of upper leaf not inflated or conspicuously ribbed and grooved.
 63a. Perianth tube well developed, (8–)12–50 mm long; stem simple or branched and then all axes single flowered.

- 64a. Tube 40–50 mm long; tepals 12–14 mm long 35. *G. stenosphon*
 64b. Tube 8–20 mm long; tepals 20–30 mm long 5. *G. fourcadei*
- 63b. Perianth tube short, 2–5 mm long; stem usually simple and 2 to several flowered.
 65a. Flower small, tepals 8–12(–14) mm long; perianth tube 2–3 mm long; flower cream to pale yellow and not turning black when dry 33. *G. juncea*
 65b. Flower medium to large, tepals 15–22 mm long; perianth tube (3–)4–5 mm long; flower deep yellow and eventually turning black when dry 34. *G. furva*
- 59b. Leaves not terete, surface either several ribbed or margins and midrib thickened or raised and the blade 2-grooved on each side; sometimes ciliate to pubescent along the edges of the ribs (edges of the margin and midrib sometimes wing-like).
 66a. Stigmas broad and flat, 3–4 mm long and at least 2 mm wide.
 67a. Perianth tube 6–9 mm long 57. *G. eury stigma*
 67b. Perianth tube 1–2.5 mm long 58. *G. mathewsii*
- 66b. Stigmas slender, recurving and not noticeably ciliate.
 68a. Bracts herbaceous to membranous, sometimes dry above but if so not brown-ferrugineous in the upper half.
 69a. Perianth tube (8–)9–11 mm long.
 70a. Flower yellow with a dark center; perianth tube longer than the bracts; stamens erect and symmetrically disposed 28. *G. darlingensis*
 70b. Flower pink to purple; perianth tube not reaching to the apex of the bracts; stamens unilateral and declinate 41. *G. brevituba*
- 69b. Perianth tube 2–8 mm long.
 71a. Tepals 5–25 mm long; leaves 2 or 3, and if 3, then the uppermost small and often becoming bract-like, sheath not inflated or several ribbed and grooved.
 72a. Flower with a perianth tube 1–7(–8) mm long.
 73a. Flowers small with the tepals 7–9 mm long and the tube 1–3(–3.5) mm long.
 74a. Plants with 2 green produced leaves, the upper of these basal, long but sheathing the stem to at least the middle and with a short free apical part; stem bearing a short, 7–12 mm long, entirely sheathing, obtuse bract below the spike 49. *G. scillaris*
 74b. Plants with 2–3 green produced leaves, the second of these sheathing the stem for a short distance and usually shorter than the basal leaf; third leaf, if present, green and only partly sheathing with a free apex and the stem without a sheathing bract below the spike.
 75a. Perianth tube ca. 1 mm long; the corm tunics hard, woody and blackish, the layers imbricate, and V-notched below 56. *G. minuta*
 75b. Perianth tube 2.5–3.5 mm long; the corm tunics soft, membranous and light brown, the layers evidently concentric 30. *G. pappi*
- 73b. Flowers medium to large with the tepals 10–22 mm long and tube 2–10 mm long.
 76a. Bracts sticky and with adhering sand.
 77a. Flower large, usually clear yellow, tepals 16–22 mm long 27. *G. humilis*
 77b. Flower smaller, cream to pale yellow usually with red markings on the reverse of the outer tepals, tepals 10–15 mm long 29. *G. hispidula*
 76b. Bracts not sticky.
 78a. Corm tunics either woody to firm and composed of distinct layers, the outer becoming broken, usually drawn into short points above.
 79a. Flowers white and with a perianth tube 2.5–3 mm long and tepals 9–12 mm long and 5–6 mm wide 48. *G. similis*

- 79b. Flowers purple and with a perianth tube 3–8 mm long and tepals 10–20 mm long and 6–9 mm wide.
- 80a. Perianth tube 3–6 mm long; spike 4–10-flowered 26. *G. purpurascens*
- 80b. Perianth tube 7–8 mm long; spike 1–4-flowered 25. *G. lithicola*
- 78b. Corm tunics either fibrous or composed of soft membranous layers, seldom accumulating, or the outer becoming fibrous.
- 81a. Perianth tube 2–4.5 mm long and the tepals less than 13 mm long.
- 82a. Flowers white and with a perianth tube 2.5–4 mm long; usually 2 long leaves produced and the third mostly sheathing and bract-like 36. *G. umbrosa*
- 82b. Flowers purple and with a perianth tube 2–3 mm long; only the basal leaf produced and the other 2 or 3 mostly sheathing and bract-like with short free apices 37. *G. alticola*
- 81b. Perianth tube 5–10 mm long, if less then the tepals at least 14 mm long.
- 83a. Flowers blue-purple to violet and the tube 5–8(–10) mm long; bracts ca. 10 mm long 38. *G. hesperanthoides*
- 83b. Flowers pale bluish with a pale center and the tube 4–6 mm long; bracts 6–9 mm long 39. *G. cataractarum*
- 72b. Flower with a perianth tube more than 8 mm and to 18 mm long.
- 84a. Perianth tube 10–18 mm long, well-exserted from the bracts at anthesis; tepals 17–22 mm long, pink to pinkish purple 40. *G. nubigena*
- 84b. Perianth tube 5–8(–10) mm long, not or barely exserted from the bracts at anthesis; tepals 12–18 mm long, blue-purple to violet 38. *G. hesperanthoides*
- 71b. Tepals at least 10 mm long and leaves 3, with the uppermost large and with an inflated, several ribbed and grooved sheath.
- 85a. Tepals white to yellow, with or without a dark purple to brown center; without a pit in the midline of the tepals.
- 86a. Flowers with the tepals cupped when fully open 53. *G. louisabolusiae*
- 86b. Flowers with the tepals spread horizontally when fully open.
- 87a. Lower two leaves filiform and with only the margins and midrib thickened.
- 88a. Plants short, 4–12(–17) mm high; spike 1–3(–5)-flowered; flowers often with a dark center 51. *G. purpureolutea*
- 88b. Plants medium to tall, to 12–20 mm high; spike 4–10-flowered; flowers cream to pale yellow throughout 55. *G. sulphurascens*
- 87b. Lower two leaves linear, with the margins and two or more other veins thickened.
- 89a. Perianth tube 2–8 mm long, but if only 2–4 mm then the flower not dark in the center 50. *G. imbricata*
- 89b. Perianth tube 2–4 mm long and the flower dark in the center 51. *G. purpureolutea*
- 85b. Tepals deep purple with white and red markings with a conspicuous pit in the midline 59. *G. radians*
- 68b. Bracts dry and brown-ferrugineous at least in the upper half at flowering time.
- 90a. Plants with 3 green leaves, and lacking bracts below the spike 79. *G. inflexa*
- 90b. Plants with 3 green leaves, and bearing 1 or 2 dry sheathing bracts below the spike.
- 91a. Tepals ca. 10 mm long 74. *G. divaricata*
- 91b. Tepals 12–17 mm long 75. *G. subrigida*

NOTE ON CITATION OF SPECIMENS AND
SPECIMEN PRESERVATION

Specimens examined are arranged according to the grid reference system based on geographical degree co-ordinates of latitude and longitude in current use in southern Africa (Edwards & Leistner, 1971). All type material cited was seen unless indicated to the contrary.

Descriptions are based on both fresh and the available dried material but measurements are based on living plants. A shrinkage factor of 10% or more may be expected for leaves and flower parts, depending on the care and method of preservation. Flower color fades progressively in dry specimens, eventually changing completely, becoming darker and sometimes ultimately disappearing. Color notes on collected specimens are desirable and are frequently mentioned by collectors.

SUBGENUS *WEIHEA*

1. Subgenus *Weihea* (Ecklon ex Baker) Goldbl., stat. nov. *Geissorhiza* section *Weihea* Ecklon ex Baker, J. Linn. Soc., Bot. 16: 95. 1878; Foster, Contr. Gray Herb. 135: 39. 1941. *Weihea* Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 22. 1827, nom. nud. TYPE: *Geissorhiza ovata* (Burm. f.) Asch. & Graeb. [as *G. excisa* (Thunb.) Ker, lectotype effectively designated by Foster (1941)].

Corms with concentric, brownish tunics, *leaves* lanceolate to ensiform or linear, and blade plane, or with the margins and midrib thickened, then sometimes terete, smooth rarely ciliate-pubescent, *stem* smooth, rarely ciliate, *spike* 1 to several flowered, *bracts* herbaceous, sometimes becoming dry above, rarely ferrugineous, *flowers* hypocrateriform, stellate or declinate, tube about as long as the bracts, or very short, or extremely long (section *Engysiphon*), stamens equal, rarely included in the tube.

Species. 47.

Distribution. Figure 6.

SECTION *WEIHEA*

1. Section *Weihea*. TYPE: *G. ovata* (Burm. f.) Asch. & Graeb.

Geissorhiza subsection *Foliosae* Foster, Contr. Gray Herb. 135: 55. 1941. TYPE: *G. foliosa* Klatt, nom. superfl. pro subsection *Weihea*.

Corm tunics woody to firm or soft in texture, *leaves* lanceolate to ensiform or linear, blade

plane, smooth, occasionally terete and 4-grooved, *stem* smooth, *spike* 1 to several flowered, *bracts* herbaceous, rarely becoming dry above, *flowers* hypocrateriform or declinate, tube about as long as the bracts, or to about twice as long.

Species. 18.

1. *Geissorhiza inconspicua* Baker, Kew Bull. 1906: 26; Foster, Contr. Gray Herb. 135: 65–66. 1941. TYPE: South Africa. Cape: George, Montagu Pass, *Penther* 713 (holotype, K). FIGURE 19.

Geissorhiza violacea Baker, Kew Bull. 1906: 26. 1906; Foster, Contr. Gray Herb. 135: 61. 1941. TYPE: South Africa. Cape: Knysna, "Blau Krantz" River, *Penther* 677 (holotype, K).

Plants 10–18(–30) cm high. *Corm* globose, asymmetric with an obliquely flattened side extending downward shortly, 5–8 mm diam., tunics concentric, dark brown, outer layers sometimes becoming papery and soft, fragmenting irregularly into sections. *Cataphyll* pale, membranous, often evidently lacking. *Leaves* 3–5, usually erect, 2.5–6 mm wide, ensiform to linear, one to two-thirds as long as the stems, lower 2–3 basal, upper cauline and smaller, uppermost often bract-like. *Stem* erect, simple or more often 2–5-branched, both from base and upper stem nodes. *Spike* (1–)3–7-flowered; *bracts* 6–8 mm long, herbaceous, becoming membranous above and usually reddish along the margins, inner about as long as outer. *Flowers* stellate, either blue to purple (purple-pink when faded) or white to cream with pink on reverse of outer tepals; *perianth tube* 4–5(–6) mm long, cylindric, reaching nearly to the apex of the bracts; *tepals* 8–11(–15) mm long, obovate, 5–6 mm wide. *Filaments* 4–6(–8) mm long; *anthers* 3–4 mm long, pollen yellow. Ovary 2–3 mm long; *style* dividing at apex of anthers, branches ca. 2 mm long, recurved. *Capsule* obovoid, 5–7 mm long. *Chromosome number*, $2n = 26$ (*Vlok* s.n. no voucher, George).

Flowering time. (September to) October to November at low altitudes, occasionally to February at highest altitudes.

Distribution. From the Langeberg near Swellendam to Port Elizabeth, montane or on flats along the coast. Figure 19.

As circumscribed here, *Geissorhiza inconspicua* comprises forms with either white or blue- to purple-colored flowers. The type collection of *G. inconspicua* has white flowers and plants matching the type exactly. They occur in montane hab-

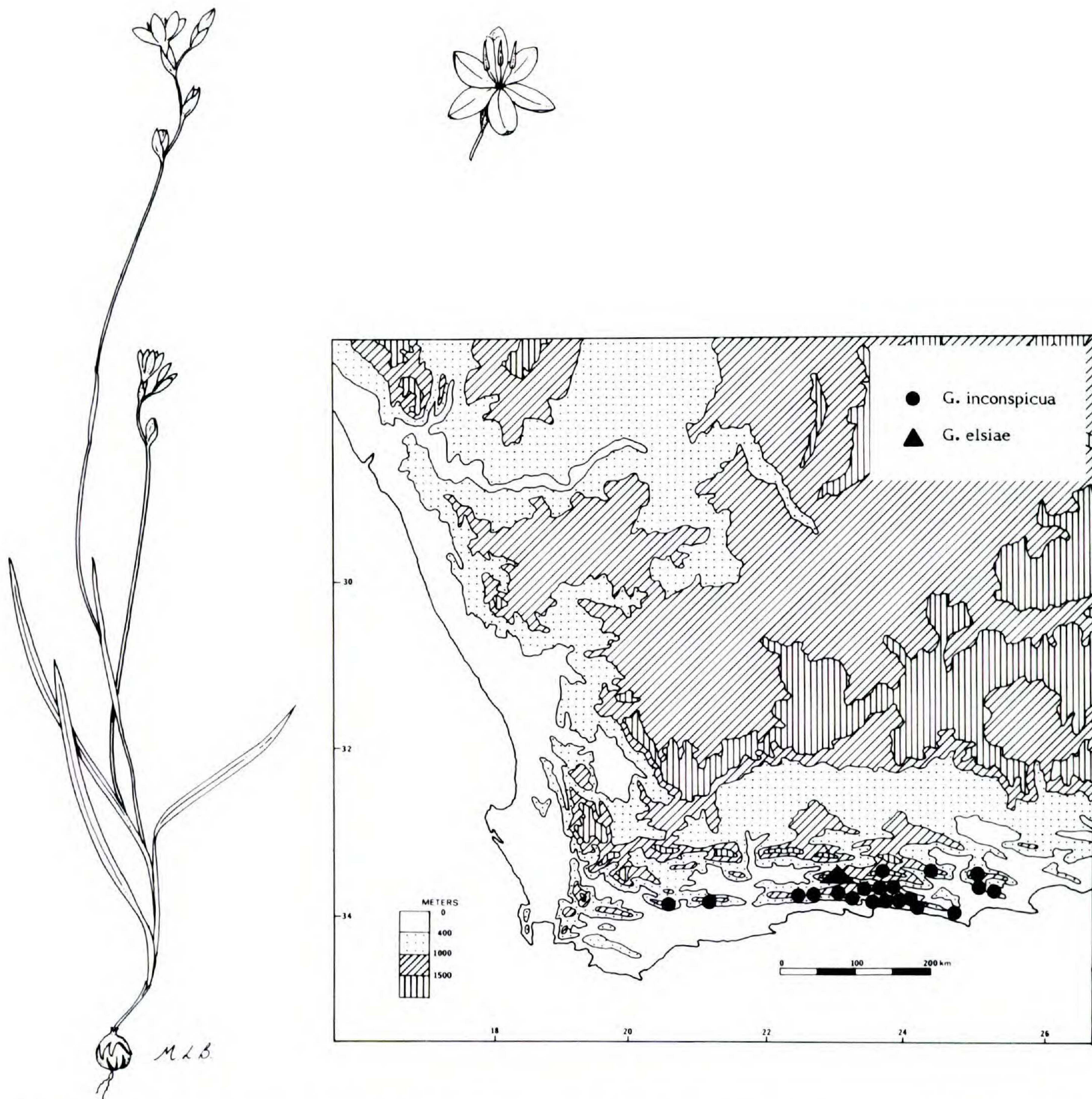


FIGURE 19. Morphology of *Geissorhiza inconspicua* and distribution of *G. inconspicua* and *G. elsiae*. Habit $\times 0.5$; flower life size (*Vlok 515*, Baviaanskloof Mts.).

itats from Swellendam in the west to near Uitenhage in the east. In the center of its range, in the Tsitsikamma Mountains and along the adjacent coast, there is a blue- or purple-flowered form that matches in all respects the white-flowered plants except for the flower color. All the collections of this form, many of which comprise several individuals, are uniformly purple-flowered, which suggests that there is no intrapopulational variation for flower color. The purple-flowered plants appear to correspond to the type of *G. violacea*, a specimen in rather poor condition. Except for flower color it is impossible to distin-

guish specimens typical of *G. inconspicua* from the several collections of purple to bluish flowered plants, and *G. violacea* is here reduced to synonymy.

Geissorhiza inconspicua can usually be distinguished from other species of the genus by its rather short leaves clustered at the base of the plant and its typically well-branched stems with several flowered spikes held well above the leaves. It is closely related to *G. bracteata* which also has rather short leaves, but it differs in having spikes of 1–2 (rarely 3) flowers in contrast to the several usually found in *G. inconspicua*. How-

ever, smaller and fewer flowered specimens of *G. inconspicua* may be extremely difficult to distinguish from some individuals of *G. bracteata*.

Geissorhiza inconspicua can also be difficult to distinguish from the Langeberg species, *G. foliosa*. This species has distinctive, short and often relatively broad, lanceolate leaves in contrast to the longer, ensiform to linear leaves of *G. inconspicua*. In addition, *G. foliosa* usually has larger flowers than those of *G. inconspicua*, with tepals 13–17 mm long and anthers 4–6 mm long while in *G. inconspicua* the tepals are 8–11(–15) mm long and the anthers 3–4 mm long.

The species is probably very close to the ancestral stock of *Geissorhiza* and it has no characteristics that appear to be in any way specialized. It has probably persisted in the relatively temperate and well-watered southern Cape with very little change since at least the Pliocene.

Specimens examined. SOUTH AFRICA. CAPE: 3320 (Montagu) Tradouw Pass, 1,400 ft. (DC), *Wurts* 2186 (NBG); Swellendam hiking trail, Langeberg Mts., *Esterhuysen* 35605 (K, MO, PRE, S, US, WAG); 9 mi. from Barrydale on the road to Heidelberg, *Marsh* 958 (K).

3321 (Ladismith) S end of Garcias Pass (CC), *Lewis* 5641 (NBG); Garcias Pass (CC), *Thorne s.n.* (SAM 41607).

3322 (Oudtshoorn) Power Station above George (CD), *Gillett* 2095 (BOL, STE); Montagu Pass, *Hutchinson* 1216 (BOL, K), *Rehmann* 63 (BM, BR, Z), *Schlechter* 5796 (B, BM, BOL, BR, E, G, GH, K, PRE, S, UC, Z); Outeniqua Pass, *Barker* 7657 (NBG), *Werdermann & Oberdieck* 862 (B, K, PRE); S slopes of Tierkop, Outeniqua Mts., 1,500 m, *Vlok* 356 (MO, SAAS); Hooheberg, Knysna (DD), *Keet* 977 (PRE), 1048 (PRE).

3323 (Willowmore) Kirby (CD), *Fourcade* 6130 (STE), 6212 (BOL); 6 mi. E of Keurboom Strand, *Lewis* 6166 (NBG); Kouga Mts., near Smutsberg (DA), *Esterhuysen* 10772 (BOL, K, NBG, PRE); Lottering, Knysna Div. (DC), *Laughton* 68 (BOL); Blaaukrantz Forest Reserve, *Middlemost* 1805 (NBG, SAM); Bloukrans, *Barker* 6050 (NBG); Helpmekaar Peak, 4,800 ft., S slopes, *Compton* 4500 (NBG); De Hoek, near Joubertina, N foot of the Tsitsikamma Mts. (DD), *Esterhuysen* 27317 (BOL, MO, PRE, US); slopes of the Tsitsikamma Mts., near Joubertina, *Esterhuysen* 16757 (BOL), 13315 (BOL), 18349 (BOL, K); Elandsbosrivier, Tsitsikamma Park, *Bower* 604 (PRE).

3324 (Steytlerville) Wit Els Berg (CC), *Esterhuysen* 6786 (BOL); Cockscomb, Great Winterhoek Mts. (DB), *Esterhuysen* 28009 (BOL).

3325 (Port Elizabeth) Van Stadens Mts., 1,500 ft. (CC), *Thompson* 1862 (PRE); Blueberg, Loerie Forest Reserve, *Dix* 55 (BOL).

3423 (Knysna) near Plettenberg Bay (BB), *Salter* 6947 (BOL, STE), *Rodin* 1175 (BOL, K, MO, PRE, UC); Smart sub *Rogers* 27959 (Z); Keurbooms River (AB), *Schlechter* 5949 (B, Z).

3424 (Humansdorp) Groot River, veld (AA), *Barker*

6053 (NBG, STE); Baviaanskloof Mts., above the farm Enkeldoorn, 1,300 m (CB), *Vlok* 515 (K, MO, SAAS).

LOCALITY UNCERTAIN: Blaaubosch Pass, S side, *Fourcade* 2823 (BOL, K, STE); Ratelsbos flats, *Fourcade* 352 (BOL).

2. *Geissorhiza elsiae* Goldbl., sp. nov. TYPE: South Africa. Cape: Kammanassie Mts., Mannetjiesberg, 4,000–5,000 ft., S slopes, *Esterhuysen* 6412 (holotype, BOL; isotypes, BOL, K, PRE). FIGURE 1.

Planta 14–25 cm alta, foliis 4–5, basalibus lineare-ensiformibus planis, superiore caulem vaginanti, caule erecto, bracteam brevem ferenti, spica florum 2–4, floribus stellato-hypocrateriformibus purpureis, tubo 6–10 mm long, tepalis 15–20 mm longis, antheris 5–6 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants 14–25 cm high. *Corm* globose with one side flattened below, 7–10 mm diam., tunics concentric, dark brown. *Cataphyll* pale, membranous. *Leaves* (3–)4–5, erect to falcate, at least the lower 3 basal, (2–)3–6 mm wide, ensiform to linear, reaching to the base of the spike or only half to one-third as long as the stems, upper cauline and becoming smaller, sometimes uppermost bract-like. *Stem* erect, simple or branched from the upper 1–2 stem nodes. *Spike* 2–4-flowered; *bracts* 12–14 mm long, evidently herbaceous, becoming reddish above and on the veins, the inner usually shorter than the outer. *Flowers* stellate-hypocrateriform, purple with darker markings in the lower midline of the tepals (becoming colorless when dry); *perianth tube* 6–10 mm long, cylindric, initially reaching to about the apex of the tube, later shortly exerted; *tepals* 15–20 mm long, obovate, 7–8 mm wide. *Filaments* 6–11 mm long; *anthers* 5–6 mm long, pollen yellow. Ovary 2–3 mm long; *style* dividing at apex of anthers, branches to 3 mm long, recurved. *Capsule* 7–9 mm long, ovoid. *Chromosome number*, unknown.

Flowering time. Late October to mid-November.

Distribution. South slopes of the Kammanassie Mountains in the Little Karoo, in cool damp sites. Figure 19.

This species is known only from three collections made by Elsie Esterhuysen and recently by Jan Vlok, in the Kammanassie Mountains, an isolated range in the Little Karoo, lying between the coastal Outeniqua and interior Swartberg Mountains. It is clearly related to the more widespread *G. inconspicua*, which occurs along the

coastal Langeberg, Outeniqua and Tsitsikama ranges from Swellendam in the west to Uitenhage in the east. *Geissorhiza elsiae* can be distinguished from *G. inconspicua* by its larger flowers, 1–4-flowered spike and less branched habit, with the branches, when present, produced from the upper nodes rather than from near the base. It also bears some resemblance to *G. roseoalba*, which has a similar habit, but somewhat larger and zygomorphic, declinate flowers.

Specimens examined. SOUTH AFRICA. CAPE: 3322 (Oudtshoorn) Kammanassie Mts., near Laudina (DB), *Esterhuysen s.n.* (BOL); Mannetjiesberg, Kammanassie Mts., *Esterhuysen 6412* (BOL, K, PRE); S slopes of Mannetjiesberg in moss near waterfall, 5,100 ft., *Vlok 803* (MO).

3. *Geissorhiza roseoalba* (Lewis) Goldbl., comb. nov. *Acidanthera roseoalba* Lewis, S. African Gard. 23: 266. 1933. *Engysiphon roseoalbus* (Lewis) Lewis, J. S. African Bot. 7: 24. 1941. FIGURE 20. TYPE: South Africa. Cape: Doorn River, George, *Fourcade 4744* (holotype, BOL; isotypes, BOL "Herb. Fourcade," STE).

Plants 15–20 cm high. *Corm* globose, more or less asymmetric with an oblique flat side, 8–10 mm diam., tunics concentric, dark brown, woody, fragmenting irregularly into segments. *Cataphyll* pale, membranous, often evidently lacking. *Leaves* 3–5, erect to falcate, the lower 2–3 basal, the upper cauline and becoming smaller, sometimes uppermost bract-like, 3–6 mm wide, ensiform to linear, usually reaching to about base of spike or shorter. *Stem* erect, simple or 1-branched, from an upper node. *Spike* 1–3-flowered; *bracts* 14–18(–25) mm long, herbaceous, becoming membranous above and often reddish along the margins, the inner equal to or somewhat shorter than the outer. *Flower* zygomorphic, declinate, whitish inside with red markings near base of tepals, reddish on reverse of tepals; *perianth tube* 8–10 mm long, cylindric, initially not exerted from the tube, sometimes becoming shortly exerted later; *tepals* 22–32 mm long, oblong to obovate, 10–15 mm wide. *Filaments* equal, declinate, 12–20 mm long; *anthers* 6–8 mm long, pollen yellow. Ovary ca. 4 mm long, *style* dividing at the apex of the anthers, branches 3–4 mm long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (*Vlok 706*).

Flowering time. August to September.

Distribution. Southern Cape in the Outeniqua, Kammanassie, Great Winterhoek, and Baviaanskloof Mountains. Figure 20.

Geissorhiza roseoalba was originally assigned to the artificially constituted genus *Acidanthera* when first described (Lewis, 1933). Shortly afterward, when Lewis (1941) reviewed this genus, she transferred *G. roseoalba* to the new genus *Engysiphon*. It differs markedly from the other species that were placed in *Engysiphon* in having three to five fairly soft-textured leaves with a plane lamina in contrast to the one to two firm leaves with heavily thickened and viscid margins of the remaining species of *Engysiphon*, now *Geissorhiza* section *Engysiphon*. It seems likely that *G. roseoalba* is not at all related to the species of section *Engysiphon* but is probably allied to the primitive *G. inconspicua* of subgenus *Weihea* section *Weihea*. It is accordingly assigned to this section where it stands out as being one of the largest flowered species in the alliance and one of the two in the section with a zygomorphic flower with declinate stamens and style.

Geissorhiza elsiae, a local endemic of the Kammanassie Mountains, is particularly reminiscent of *G. roseoalba*, and it is difficult to draw the line between the two species from dried material when the important details of the orientation of style and stamens are often not clear. *Geissorhiza elsiae*, however, has symmetrically disposed stamens and flowers that seldom reach the size of those of *G. roseoalba*.

Geissorhiza roseoalba is apparently restricted to dry fynbos and it extends from near Calitzdorp in the Little Karoo, eastwards through the Long Kloof and Baviaans Kloof to the Winterhoek Mountains near Uitenhage. It is poorly collected despite its fairly wide distribution and was only recently discovered in the Gamka Nature Reserve near Calitzdorp by J. J. Vlok and in the Uitenhage district by H. T. Scharf, significant range extensions for the species. It blooms from August in drier inland sites to late September in the higher rainfall areas towards the coast.

Specimens examined. SOUTH AFRICA. CAPE: 3321 (Ladismith) Gamka Nature Reserve, moist sandy S slopes (DA), *Vlok 318* (MO, SAAS); Attaquaskloof, Paardevlei Mts., 1,600 ft. (DD), *Vlok 706* (MO, SAAS).

3322 (Oudtshoorn) Doorn River, George (CC), *Fourcade 4744* (BOL, STE); between Doorn River and the top of Montagu Pass (CD), *Fourcade 5241* (PRE); farm Croxden, Waboomskraal, George, *O'Connor s.n.* (K, PRE); Buffelsrivier, SW of Kammanassieberg, 2,900 ft. (DA), *Oliver 3645* (K, PRE, STE).

3324 (Steytlerville) Baviaanskloof Mts., between



FIGURE 20. Morphology and distribution of *Geissorhiza roseoalba*. Habit $\times 0.5$; flower life size (*Vlok 706*, *Attaquaskloof*).

Smitskraal and Wilgehof, 3,500 ft. (CB), *Oliver 4586* (K, STE).

3325 (Port Elizabeth) Deyse's Plaat farm, Groendal Wilderness Reserve (CA), *Scharf 1930* (PRE); Groendal Wilderness Reserve, Enon Conglomerate, on a burnt S-facing slope, *Scharf 1517* (PRE).

4. *Geissorhiza outeniquensis* Goldbl., sp. nov.
TYPE: South Africa. Cape: George, Jonkersberg, Outeniqua Mts., wet rocky stream banks and waterfalls, *Esterhuysen 19379*

(holotype, BOL; isotypes, K, PRE). FIGURE 21.

Planta 20–50 cm longa, caespitosa decumbenti, foliis 4-pluribus planis inferioribus basalibus superioribus caulem vaginante, caule decumbenti, spica florum 2–4, floribus hypocrateriformibus, carneis ad purpureis, tubo 10–13 mm longo, tepalis 26–32 mm longis, antheris 6–9 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants 20–50 cm long, usually decumbent or

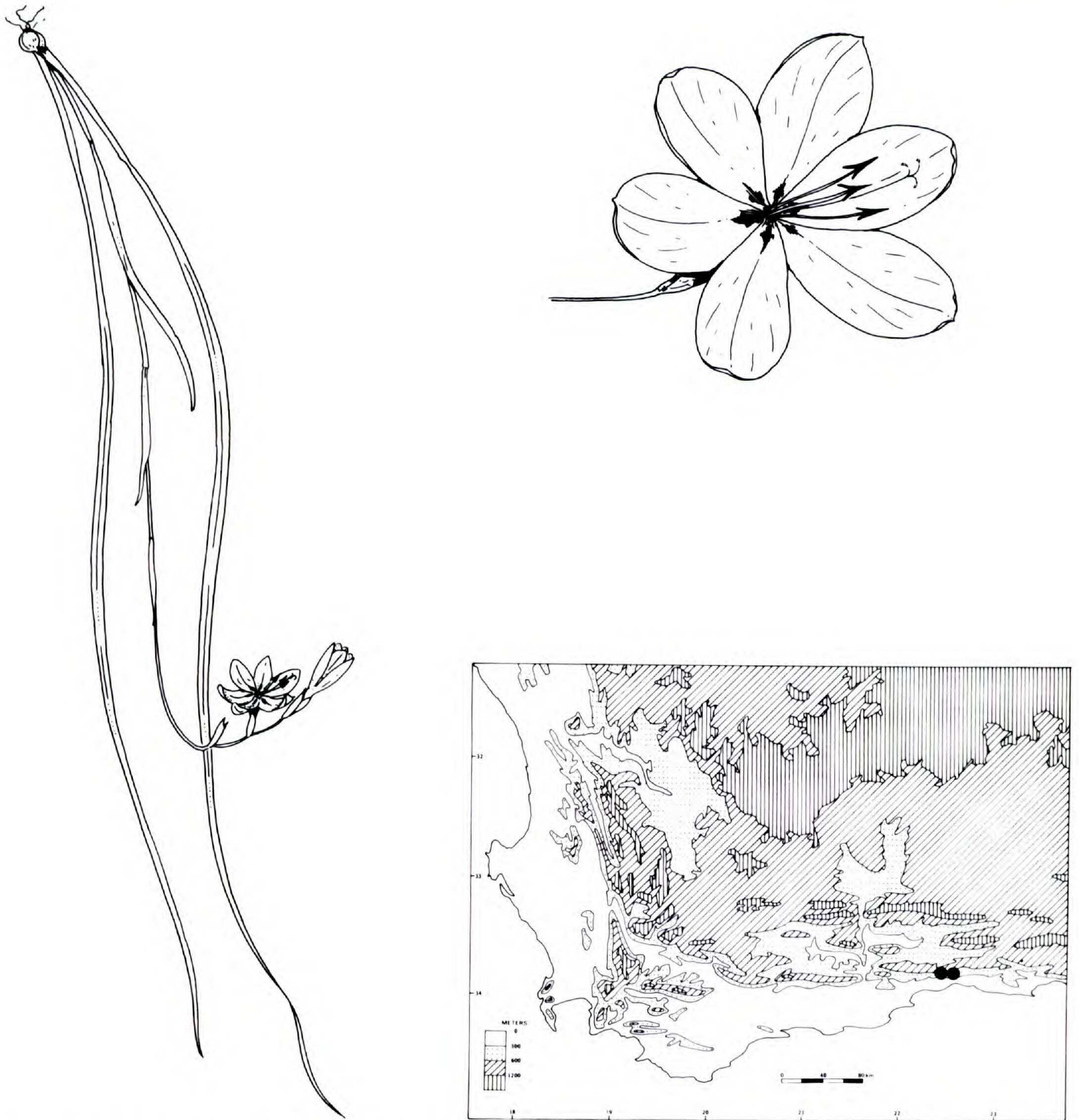


FIGURE 21. Morphology and distribution of *Geissorhiza outeniquensis*. Habit $\times 0.25$; flower life size (Vlok 525, Outeniqua Pass).

trailing, forming clumps. *Corm* depressed-globose, symmetric, 6–8 mm diam., tunics apparently concentric, light brown, papery and soft, decaying readily. *Cataphyll* evidently lacking. *Leaves* 4 to several, decumbent to trailing, at least the lower two basal, upper cauline and becoming smaller and sometimes bract-like, 3–6 mm wide, linear, usually reaching to the base of the spike, sometimes longer. *Stem* decumbent, unbranched. *Spike* 2–4-flowered; *bracts* 16–20 (–24) mm long, herbaceous, becoming submembranous above, the inner slightly shorter than the outer. *Flower* zygomorphic, declinate, pink

to purple with darker markings near the base of the lower tepals, purple on the reverse; *perianth tube* 10–13 mm long, cylindric, about as long or slightly longer than the bracts; *tepals* 26–32 mm long, oblong, 10–14 mm wide. *Filaments* equal, declinate, 15–20 mm long; *anthers* 6–8 mm long, pollen yellow. *Ovary* ca. 5 mm long, *style* dividing at the apex of the anthers, branches 3–4 mm long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (Vlok 525).

Flowering time. December to mid-January.

Distribution. Local in the Outeniqua Mountains, in shady situations near water. Figure 21.

Geissorhiza outeniquensis has until now been considered a form of the more widespread *G. roseoalba*, which until recently was referred to the genus *Engysiphon*. It clearly belongs in section *Weihea* and seems closely related to *G. roseoalba*. These are the only two species of the section which have a zygomorphic flower with declinate stamens and style. They also have the largest flowers in the section and are so distinctive that they are unlikely to be confused with other species of the section. The flowers of *G. outeniquensis* are very similar to those of *G. roseoalba* but are normally slightly larger and have a longer perianth tube, some 10–13 mm long, compared to 8–10 mm in *G. roseoalba*. The very soft textured corm tunics of *G. outeniquensis*, however, are so different from those of *G. roseoalba* that the two species are unlikely to be confused.

Geissorhiza outeniquensis is apparently restricted to the Outeniqua Mountains immediately around George, where it occurs in moist shady kloofs, along streams and waterfalls. It has an unusual caespitose habit, with the main plants producing short runners which sprout to form new stems and leaf clusters. The species seems to have lost the deciduous habit of the genus, and does not die back and become dormant during the later summer and autumn.

Specimens examined. SOUTH AFRICA. CAPE: 3322 (Oudtshoorn) Jonkersberg, Outeniqua Mts., stream banks and waterfalls (CC), *Esterhuysen* 19379 (BOL, K, PRE); Outeniqua Pass, streambanks and seepages (CD), *Acocks* 21738 (B, K, NBG, PRE), *Vlok* 525 (MO, NBG, PRE); "Geelhoutbosch," George, damp places, *Taylor* 1628 (BOL); Montagu Pass, *McNeil & Ising* s.n. (PRE), *Zinn* s.n. (SAM 54823).

5. *Geissorhiza fourcadei* (L. Bolus) Lewis, J. S. African Bot. 7: 32. 1941. *Acidanthera fourcadei* L. Bolus, Ann. Bolus Herb. 4: 118. 1928. TYPE: South Africa. Cape: S slopes of Witte Els Berg, Humansdorp, *Fourcade* 2968 (lectotype, BOL; isolectotypes, BOL "Herb. Fourcade," MO, PRE, S, STE). FIGURE 22.

Plants 15–30 cm high. *Corm* nearly spindle-shaped, 6–10 mm diam., corms of previous seasons persistent and accumulating below current corm, tunics brown, woody to soft-papery, layers concentric but sometimes apparently imbricate by displacement especially when soft, fragmenting irregularly from above and below, outer layers sometimes becoming fibrous, extending upward in a neck together with decaying leaves. *Cataphyll* membranous, light to dark brown.

Leaves 3–5, terete or nearly terete, the margins and midrib actually much enlarged, and thus narrowly 4-grooved, half as long to as long as the stem, the lower 2–4 leaves basal, the uppermost cauline, partly to entirely sheathing, shortest. *Stem* erect, smooth, simple or 1–2-branched, bearing one partly sheathing foliage leaf and 2–3 dry sheathing stem bracts. *Spike* single flowered (both main and lateral axes); *bracts* herbaceous, drying near the apex, (12–)16–30 mm long, the inner as long, or slightly shorter than the outer. *Flower* hypocrateriform, pink to mauve; *perianth tube* (8–)17–20 mm long, cylindric, widening gradually towards the apex, exserted, or just short of the apex of the bracts; *tepals* 25–30 mm long, oblanceolate, to 11 mm wide. *Filaments* 13–20 mm long, equal; *anthers* 10–12 mm long. *Ovary* ca. 4 mm long, *style* declinate, dividing beyond the anthers, branches recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. Mid-January to early May.

Distribution. Mountains of the southern Cape, in seasonally moist sites, such as seeps, streamsides, and marshes. Figure 22.

Geissorhiza fourcadei is distinctive in *Geissorhiza* in the persistent bases of leaves and cataphylls which accumulate in a neck around the stem base and in the spike and its branches always being single flowered. It is also peculiar in that the corms of past seasons often persist instead of decaying, so that a series of old corms accumulate behind the current year's corm. It is also unusual in its late summer to autumn blooming habit. The affinities of *G. fourcadei* are uncertain but the corm tunics correspond fairly well to the concentric type characteristic of subgenus *Weihea*. It seems isolated in the subgenus but is best placed in section *Weihea* in which there is a marked tendency to the reduction of the number of flowers in the spike. It stands out in the section in its terete 4-grooved leaf. Difficulties in placing the species to subgenus arise because the corm tunics are often soft in texture, sometimes even fibrous, and are then easily displaced from their concentric position when uprooted. The tunics then match neither the typical concentric tunics of subgenus *Weihea* nor correspond well with the imbricate tunics of subgenus *Geissorhiza*. The tunic layers of some collections, notably *Vlok* 812, are hard and perfectly concentric, and it seems clear that the tunics are basically concentric even though they are often easily displaced when disturbed.

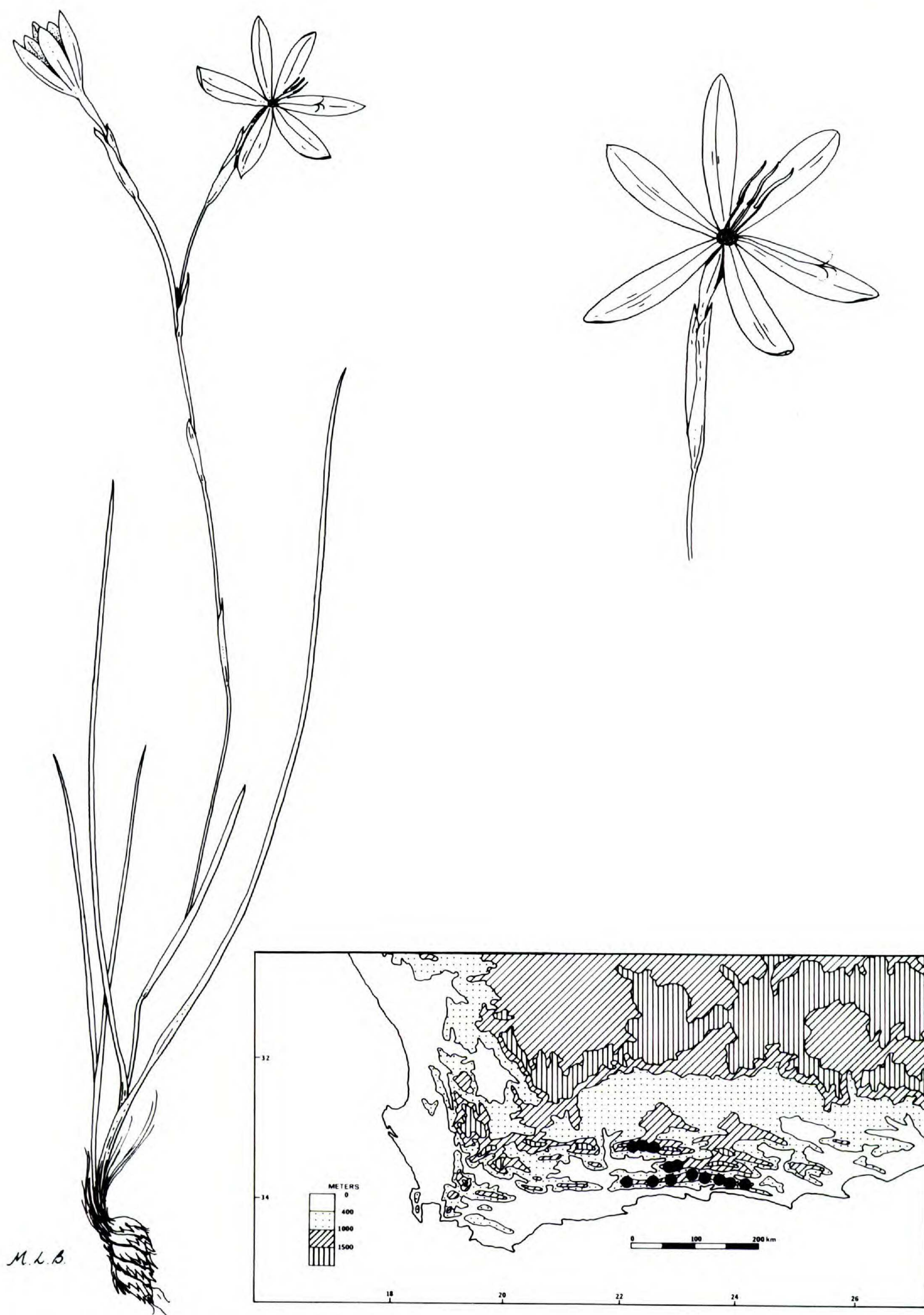


FIGURE 22. Morphology and distribution of *Geissorhiza fourcadei* (from dried plants and photographs). Habit $\times 0.5$; flower life size (*Esterhuysen 4584*, Helpmekaar Peak).

Geissorhiza fourcadei occurs in sandy soils, probably always in damp situations, in the southern Cape mountains. It has been recorded from Robinsons Pass, at the western end of the Outeniqua Mountains almost to the eastern end of the Outeniqua-Tsitsikamma ranges at Witte Els Berg. Outlying populations have been recorded inland on the Kammanassie Mountains and at a few sites in the Swartberg Mountains to the north, between Meirings Poort and Swartberg Pass. A collection from the summit of Blouberg, *Thompson 2226*, stands out as having unusually short bracts (12–15 mm long) and perianth tube (ca. 8 mm long) but otherwise matches *G. fourcadei* well. It seems to represent nothing more than a depauperate population as other collections from the Swartberg Mountains are close to the typical form from the Outeniqua Mountains. A second Swartberg collection, *Thorne s.n.*, has longer bracts (14–20 mm long) and perianth tube (14–20 mm long), linking the unusual Thompson collection to those from the south.

Specimens examined. SOUTH AFRICA. CAPE: 3322 (Oudtshoorn) top of Swartberg Pass next to the road, 5,400 ft. (AC), *Vlok 812* (MO); summit of Spitzkop, W of Meirings Poort (AD), *Thorne s.n.* (SAM 50192); Swartberg, summit ridge SW of Blouberg, 5,800 ft., *Thompson 2226* (STE); Blesberg, near radio tower, 6,800 ft. (BC), *Vlok 805* (MO); Robinsons Pass, near water courses (CC), *Hops 17* (BOL); Cradock Peak, Montagu Pass (CD), *Zinn s.n.* (SAM 54824); Kleinberg Forest Reserve, Kammanassie Mts., 2,600 ft. (DA), *Mathews 1182* (NBG); Kammanassie Mts., Mannetjiesberg (DB), *Esterhuysen 4838* (BOL), *Bond 931* (NBG), *Mathews 1074* (NBG); S slopes of Mannetjiesberg, 4,000–5,000 ft., *Esterhuysen 18372* (BOL, K, PRE); Stormberg, Outeniqua Mts., steep S slopes (DD), *Taylor 1135* (SAM).

3323 (Willowmore) top of Prince Alfreds Pass, moist shady kloof (CC), *Lavranos 12676* (PRE); S slope, Formosa (DC), *Compton 4203* (BOL, NBG); Helpmekaar Peak, *Esterhuysen 4584* (BOL, PRE), *Bond 900* (NBG); Tsitsikamma Mts., S slopes near Joubertina, 3,500–4,000 ft. (DD), *Esterhuysen 18355* (BOL, PRE), *16852* (BOL); De Hoek, Uniondale, 3,500 ft., *Esterhuysen sub Fourcade 6533* (BOL).

3324 (Steytlerville) S slopes of Witte Els Berg, 2,000–2,400 ft. (CC), *Fourcade 2968* (BOL, K, MO, PRE, S, STE).

6. *Geissorhiza foliosa* Klatt, *Linnaea* 34: 658–659. 1866; Baker, *Handb. Irid.* 158. 1892, *Fl. Cap.* 6: 74. 1896; Foster, *Contr. Gray Herb.* 135: 62. 1941. TYPE: South Africa. Cape: Swellendam, “Berge bei Puspasvlei,” *Ecklon & Zeyher Irid.* 218 (70.10) [lectotype, B, effectively designated by Foster

(1941); isoelectotypes, B, BM, E, FI, K, L, LD, MO, P, PRE, S, SAM, W, Z].

Geissorhiza nigromontana Ecklon, *Topogr. Verz. Pflanzensamml.* Ecklon 21. 1827, nom. nud. et ms. *Geissorhiza eckloniana* Pappe ms.

Plants 8–20(–30) cm high. *Corm* globose, asymmetric with an obliquely flattened side extending shortly downward, 5–10 mm diam., tunics concentric, dark brown, hard and woody, fragmenting irregularly into sections. *Cataphyll* pale, membranous, sometimes evidently lacking. *Leaves* 5 to several, erect to falcate, 3–6 mm wide, lanceolate to ensiform, typically short and seldom more than one-third as long as the stems, at least the lower 3–4 basal, the upper cauline and becoming smaller, sometimes 3–4 on a stem, uppermost often bract-like. *Stem* erect, simple or 1–2-branched, either from the base or from upper stem nodes. *Spike* 2–5-flowered; *bracts* 9–12(–15) mm long, evidently herbaceous, becoming membranous and dry above and often reddish along margins, inner usually slightly shorter than the outer. *Flowers* stellate, lilac to purple (colorless when faded), rarely white; *perianth tube* ca. 5 mm long, cylindric, included in the bracts; *tepals* 13–17 mm long, obovate, 6–7 mm wide. *Filaments* 4–5 mm long; *anthers* 4–6 mm long, pollen yellow. *Ovary* 2–3 mm long, *style* dividing at the apex of the anthers, branches 3–4 mm long, recurved. *Capsule* 7–9 mm long, narrowly ovoid. *Chromosome number*, unknown.

Flowering time. September to early November.

Distribution. Slopes and flats in the southern Cape at the foot of the Langeberg between Swellendam and Riversdale. Figure 23.

Geissorhiza foliosa is apparently related to the more common *G. inconspicua*, a predominantly montane species with a wider distribution, extending from the Langeberg near Swellendam to Port Elizabeth. It can always be distinguished from this species by its characteristic short, lanceolate leaves, which give it a very different appearance from other species of *Geissorhiza*. It differs from *G. inconspicua* also in its slightly larger flowers, with tepals 13–17 mm long and perianth tube, 5–6 mm long, which is always included in the bracts.

Geissorhiza nigromontana, a narrow endemic of the Great Swartberg Mountains, appears to be closely allied to *G. foliosa* and is perhaps a regional segregate of this species. Their similarities

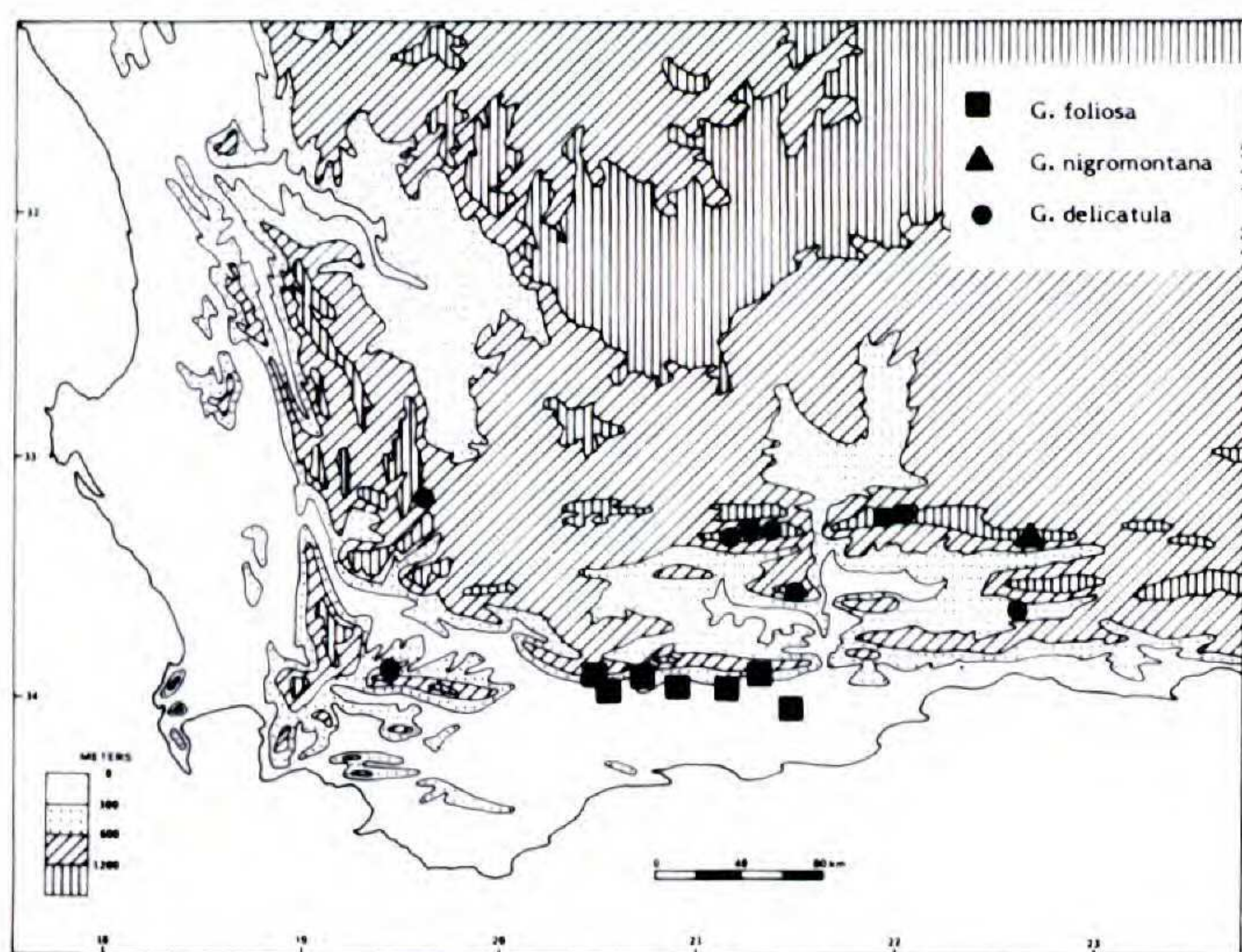


FIGURE 23. Distribution of *Geissorhiza foliosa*, *G. nigromontana*, and *G. delicatula*.

and differences are discussed under *G. nigromontana*.

Geissorhiza foliosa is poorly collected, and there are few recent collections of the species, despite the fact that it is recorded from a well-collected and easily accessible area.

Specimens examined. SOUTH AFRICA. CAPE: 3321 (Ladismith) Kampsheberg, 1,000 ft. (CD), Muir 3336 (BOL).

3420 (Bredasdorp) Swellendam (AB), Ross Frames s.n. (BOL 31888); below 10 O'Clock Mt., Swellendam, in pastureland, Wurts 438 (NBG), 480 (NBG); Koloniesbos, fynbos, van Wyk 351 (STE); roadside near Zuurbraak (BA), Hurling & Neil s.n. (BOL 31889); Buffeljagsrivier bei Rietkuil, Ecklon & Zeyher 3961 (124.10) (BM, BOL, FI, G, K, S, SAM, W, Z); Ruggens near Zuurbraak, 800 ft., Galpin 4711 (BOL), 4715 (K, PRE); "Zwellendam, berge bei Puspas Valei, Duivelsbos etc." (BA-BB), Ecklon & Zeyher Irid. 218 (70.10) (B, BM, E, FI, K, L, MO, P, PRE, S, SAM, W, Z); between Zuurbraak and Heidelberg (BB), Lewis 5655 (NBG, STE).

3421 (Riversdale) near Riversdale (AA), Muir 4718 (BOL); between Riversdale and Albertinia (AB-BA), Stayner s.n. (NBG 65206).

WITHOUT PRECISE LOCALITY: Caledon district, Pappe s.n. (SAM 20879).

7. *Geissorhiza nigromontana* Goldbl., sp. nov.

TYPE: South Africa. Cape: Groot Swartberg, Blesberg at Tierkloof, along stream, Vlok 93 (holotype, MO; isotypes, NBG, SAAS).

Planta 10–16 cm alta, tunicis cormi manifeste concentricis, papyraceis, foliis 3–6 inferioribus duobus basalibus, 4–10 mm latis falcatis, caule infra manifeste prostrato supra erecto, infra bulbilifero, spica 2–3 florum, floribus verosimiliter stellatis, caeruleo-purpureis, tubo ca. 2 mm longo, tepalis 14–16 mm longis, antheris ca. 5 mm longis, stylo diviso ad medium antherarum, ramis recurvatis.

Plants 10–16 cm high. *Corm* globose, asymmetric with an obliquely flattened side extending downward shortly, ca. 6 mm diam., tunics apparently concentric, light brown, outer layers apparently brittle-papery. *Cataphyll* pale, membranous. *Leaves* 3–6, falcate, at least the lower two basal, upper cauline and becoming smaller, sometimes 3–4 on a stem, the uppermost often bract-like, 4–10 mm wide, reaching to the base of the spike or only half to one-third as long as the stem. *Stem* apparently prostrate below, erect above, simple or sometimes branched, both from the base or from upper stem nodes, bearing cormlets from the lower nodes. *Spike* 2–3-flowered; *bracts* 8–10 mm long, green, becoming membranous above, the inner slightly shorter than the outer. *Flowers* apparently stellate, blue-purple; *perianth tube* 2–3 mm long, cylindric, included in the bracts; *tepals* 14–16 mm long, obovate, ca. 6 mm wide. *Filaments* ca. 6 mm long; *anthers* about 5 mm long, pollen yellow. *Ovary* ca. 3 mm long; *style* dividing at about the midline of the anthers, branches long, 4–5 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. January to February.

Distribution. Great Swartberg Mountains, local along streams on Blesberg at ca. 1,800 m. Figure 23.

Geissorhiza nigromontana is apparently a narrow endemic of the Swartberg Mountains, where it has been collected only twice by J. J. Vlok in 1981 and 1985. It blooms towards the end of summer, in January and probably into February, in this area of low rainfall and depends for moisture on the permanent streams along which it grows.

It apparently has fairly soft corm tunics, but few of the specimens available have corms, and their exact nature is difficult to assess with so little material to examine. *Geissorhiza nigromontana* is most probably closely related to *G. foliosa*, a species of the Langeberg foothills, which blooms mainly in the months of October and November, and it has the broad flat leaves typical of that species. It is distinctive in its short tubed flower, with the tube ca. 2 mm long, few flowered spike and relatively long style branches 4–5 mm long. In contrast, *G. foliosa* has a tube 5–6 mm long, a spike of (1–)3–7 but usually several flowers and style branches to 3 mm long. *Geissorhiza nigromontana* is also distinctive in bearing cormlets in the lower stem axils, a characteristic rare in the genus.

Specimens examined. SOUTH AFRICA. CAPE: 3322 (Oudtshoorn) lower S slopes of the Swartberg next to waterfall, near Rus en Vrede (AD), *Vlok 893* (MO, NBG, SAAS); Groot Swartberg, Blesberg at Tierkloof, along stream (BC), *Vlok 93* (MO, NBG, SAAS).

8. *Geissorhiza delicatula* Goldbl., sp. nov. TYPE: South Africa. Cape: shady mountainside, Seven Weeks Poort, *Compton 4016* (holotype, NBG; isotype, BOL).

Planta 3–9(–12) cm alta, foliis 3–6, inferioribus 2–4 basalibus planis, superiore caulem vaginanti, caule erecto simplici vel ramoso, bracteam brevem ferenti, ramis unifloribus raro ad 4 florum, floribus stellatis, pallide caeruleis, tubo 2–3 mm longo, tepalis 7–12 mm longis, antheris 2.5–3.5 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants 3–9(–12) cm high. *Corm* globose, asymmetric with an obliquely flattened side extending downward shortly, 3–8 mm diam., tunics concentric, brown, firm to soft membranous, fragmenting irregularly into sections. *Cataphyll* brown to transparent, membranous, sometimes conspicuous. *Leaves* 3–6, erect to falcate, 1.5–4.5 mm wide, linear to ensiform, often prostrate, half as long as the stems, at least the lower 2–3 basal, the upper cauline and becoming smaller, uppermost often bract-like. *Stem* erect, simple or 1–3-branched, either from the base or from the upper nodes. *Spike* usually 1, rarely to 3-flowered; *bracts* 4–8 mm long, herbaceous, becoming membranous and dry above and sometimes reddish along the margins, the inner about as long as the outer. *Flowers* stellate, pale lilac purple, cream in the throat and tube; *perianth tube* 2–3 mm long, cylindric, included in the bracts; *tepals* 7–12 mm long, obovate, 2.5–4.5 mm wide. *Filaments* 3–5 mm long; *anthers* 2.5–3.5 mm long, pollen yellow. *Ovary* 1.5–3 mm long, *style* dividing towards the apex of the anthers, branches to 1.5 mm long, recurved. *Capsule* 4–7 mm long, narrowly obovoid. *Chromosome number*, unknown.

Flowering time. August to September in drier sites, November to December at higher altitudes.

Distribution. Sheltered places in the interior mountains of the western and southern Cape from Jonas Kop in the west to the Swartberg Pass in the east. Figure 23.

Geissorhiza delicatula is apparently related to the more well known *G. inconspicua* and *G. foliosa*, both predominantly montane species of the wetter coastal ranges, extending from the Langeberg at Swellendam to near Port Elizabeth. It is

always a much smaller and more delicate plant and it can be distinguished from these species by its normally single branched stems. Even the most robust individuals of *G. delicatula* seem to have this habit. It also differs from *G. inconspicua* and *G. foliosa* in its slightly smaller flowers, with tepals 7–12 mm long and short perianth tube, 3–4 mm long, which is always included in the bracts. *Geissorhiza inconspicua* and *G. foliosa* normally have flowers with tepals 8–17 mm long and a tube 4–6 mm long, and typically have spikes of 3–6 flowers.

A collection from the Swartberg, *Oliver 3056*, seems to differ in having leaves of a somewhat firmer texture than other collections. It also has larger flowers than most other gatherings of the species, but at least in the flower size, a collection from nearby, *Stokoe s.n.* from the Swartberg Pass, is comparable. From the material available, it seems best to regard these specimens merely as a form of *G. delicatula*. All the collections of the species except *Oliver 5359* from the Rooiberg, have single flowered branches. The *Oliver* gathering, however, includes plants with one, two, or three flowers per branch. It is possible that this collection represents a very depauperate form of *G. inconspicua*.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Karooport (BA), *Hafstrom & Acocks 288* (PRE, S); Jonas Kop, ca. 3,000 ft., wet shaded sites on S side of overlying rocks (DC), *Goldblatt 4723* (MO), 5880 (MO).

3321 (Ladismith) Buffelskloof, Swartberg near Ladismith (AC), *Esterhuysen 14007* (BOL); shade on S slopes below Towerkop, *Esterhuysen 13967* (BOL); Seven Weeks Poort, mountain slopes, SW aspect (AD), *Esterhuysen 24838* (BOL); shady mountainside, Seven Weeks Poort, *Compton 4016* (BOL, NBG); above Seven Weeks Poort, *Phillips 1543* (SAM); Swartberg, between Waboomsberg and Kangoberg, 6,000 ft. (BD), *Oliver 3056* (PRE, STE); Rooiberg, summit ridge above Assegaaiboskloof (DA), *Oliver 5379* (STE).

3322 (Oudtshoorn) 8 mi. W of the top of Swartberg Pass (AC), *Stokoe s.n.* (SAM 68346); Langkloof, road to Daskop near turnoff to Matjesrivier (DC-DD), *Vlok 301* (MO).

9. *Geissorhiza bracteata* Klatt, Abh. Naturf. Ges. Halle 15: 391 (Erg. 57) 1882; Baker, Handb. Irid. 158. 1892, Fl. Cap. 6: 74. 1896; Foster, Contr. Gray Herb. 135: 62. 1941. TYPE: South Africa. Cape: Olifantshoek, Uitenhage, *Ecklon & Zeyher s.n.* (holotype, B “Herb. Lubeck”), *Ecklon & Zeyher Irid. 221* (10.9) (B, BM, E, FI, G, LD, MO, PRE, S, W, Z, from the same locality are probably isotypes). FIGURE 24.

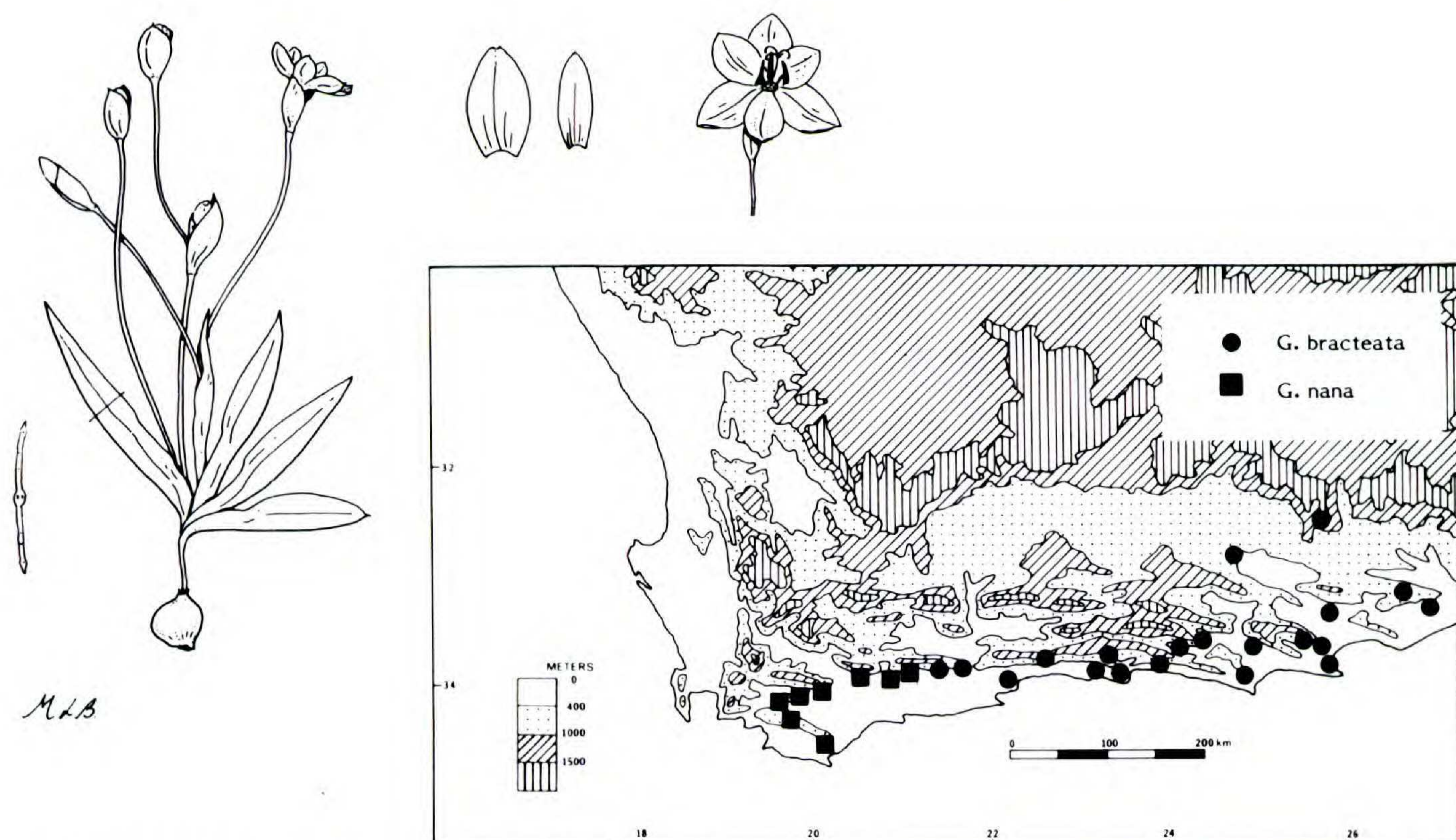


FIGURE 24. Morphology of *Geissorhiza bracteata* and distribution of *G. bracteata* and *G. nana*. Habit $\times 0.5$; flower and separated outer and inner bracts life size; leaf section much enlarged (no voucher, Uitenhage).

Weihea elatior Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 22. 1827, nom. nud.

Geissorhiza tabularis var. *elatior* Ecklon ms. [Ecklon & Zeyher Irid. 221 (10.9)].

Geissorhiza recurvifolia (Poir.) Klatt sensu Klatt, Linnaea 34: 655. 1866, pro parte excl. basion.

Plants (4–)6–18 cm high. *Corm* ovoid, asymmetric with an oblique flat side extending shortly downward, 4–6 mm diam., tunics pale to dark brown, concentric, the outer layers fragmenting irregularly into sections and drawn into points above. *Cataphyll* pale, membranous. *Leaves* (3–)4 to several, the lower basal, upper cauline and becoming smaller, sometimes bract-like, 2–9 mm wide, ensiform, half to one-third as long as the stems. *Stems* erect, single or 2–5 produced from base and occasionally higher on the stem. *Spike* usually 1-flowered, rarely 2–3; *bracts* green, often reddish along the margins, 6–10 mm long, the inner usually slightly shorter than the outer. *Flowers* stellate, white, the outer tepals sometimes red-flushed on the reverse; *perianth tube* 3–5 mm long, infundibuliform, widening from the base; *tepals* (5–)8–12 mm long, obovate, 4.5–6 mm wide. *Filaments* 5–7 mm long; *anthers* 2–3.5 mm long, pollen yellow. *Ovary* 2–3 mm long; *style* dividing at the apex of the anthers, branches recurved. *Capsule* 7–9 mm long, narrowly ovoid, seeds angular. *Chromosome number*, $2n = \text{ca. } 52$ (Goldblatt 4933).

Flowering time. September to mid-October.

Distribution. Southern and eastern Cape, from Albertinia east to Grahamstown and in the southern Karoo, often in clearings or on edge of forest. Figure 24.

Geissorhiza bracteata is one of the least specialized species in the genus, having several flat, ensiform leaves, a branched stem, and concentric corm tunics, all of which are considered primitive in *Geissorhiza*. It is closely allied to *G. inconspicua* and sometimes difficult to separate from that species. It can be recognized by its 1(–3)-flowered spikes and branches produced from the base of the plant. *Geissorhiza inconspicua* is a variable species, and depauperate, few flowered specimens of the white-flowered form approach *G. bracteata*. It is also possible to confuse *G. bracteata* (e.g., Bayliss 6035, Duthie 1132) with *G. setacea* although *G. setacea* generally has much shorter and narrower leaves, typically less than 2 mm wide. *Geissorhiza setacea* occurs on damp sandy flats in the southwestern Cape. This is well to the west of the range of *G. bracteata*, which is centered in the eastern Cape between Grahamstown and Humansdorp, although populations have been recorded as far to the west as Albertinia.

Geissorhiza bracteata appears to be a polyploid species, $2n = \text{ca. } 52$, at least on the basis

of counts for one population. This population, from near Hankey, has proved in the greenhouse to be autogamous, which is unusual in *Geissorhiza*.

Specimens examined. SOUTH AFRICA. CAPE: 3224 (Graaf Reinet) near Jansenville (DC), *Bayliss* 5925 (BR, K, MO, WAG).

3225 (Somerset East) Cradock Common (BA), *Bayliss* 4967 (GH, MO, UC, US).

3321 (Ladismith) Welgevonden near Plattebosch, Albertinia (DC), *Muir* 1811 (BOL); Cloetes Pass (DD), *Goldblatt* 4158 (MO).

3322 (Oudtshoorn) Cradock Berg, George (CD), *Galpin* 4673 (K, PRE); George, *Lewis* 5603 (NBG).

3323 (Willowmore) Avontuur-George road, farm Arbor Nook, Pootjiesrivierhoogte (CA), *Snijman* 365 (NBG); station above Uplands, 11.3 mi. from Kruis River Nek (CC-CD), *Fourcade* 6112 (STE); Lottering (DC), *Fourcade* s.n. (BOL).

3324 (Steytlerville) Kromme River, 4 mi. W of Company's Drift (CC), *Fourcade* 2317 (BOL); Bo Plaas, near Humansdorp (CD), *Bayliss* 6035 (MO); 5.5 km N of Hankey (DD), *Goldblatt* 4933 (K, MO, PRE, US).

3325 (Port Elizabeth) hills at Addo (BC-DB), *Ecklon & Zeyher* Irid. 220 (SAM), *Ecklon & Zeyher* Irid. 221 (S); Zuurberg Pass, cool SE-facing slopes (BD), *Snijman* 489 (MO, NBG); Groendal Wilderness Reserve (CA), *Scharf* 1493 (PRE); Despatch, Uitenhage (CD), *Holland* 2209 (BOL), *Holland* s.n. (Nat. Bot. Gard. 2687/25 in BOL); Port Elizabeth (DC), *Fries, Norlindh & Weimarck* 216 (LD, SAM), *Paterson* 152 (BOL).

3326 (Grahamstown) Grahamstown (BC), *MacOwan* 339 (SAM); along the rivulet at Grahamstown, *Burchell* 3546 (K); Mountain Drive, Grahamstown, *Bayliss* 7231 (MO); Brickfields, Grahamstown, *Daly* 861 (B, BOL, Z); Hopewell, S of Southwell (BD), *Acocks* 16127 (PRE).

3422 (Mossel Bay) between Malgaten and Great Brak Rivers (AA), *Fourcade* 6481 (BOL); turf near Church, Belvedere, Knysna (BB), *Duthie* 1132 (BOL, MO, STE).

3423 (Knysna) flats 14 mi. E of Knysna (AA), *Gillett* 1348 (BOL).

3424 (Humansdorp) hillside, Humansdorp (BB), *Galpin* 4674 (K, PRE).

WITHOUT PRECISE LOCALITY: Riversdale hills, *Schlechter* s.n. (B); Uitenhage, *Ecklon & Zeyher* s.n. (10.9) (B, L); Zuurberg near Uitenhage, *Loubser* 898 (NBG); Cape, *Krebs* 799 (B), *Verreaux* s.n. (G); Olifantshoek, Uitenhage, *Ecklon & Zeyher* Irid. 221 (10.9) (B, BM, E, FI, G, LD, MO, PRE, W, Z); Uitenhage, *Zeyher* s.n. (K); Mossel Bay-Barrington, *Fries, Norlindh & Weimarck* 1287 (K, LD, PRE).

10. *Geissorhiza nana* Klatt, Abh. Naturf. Ges. Halle 15: 391 (Erg. 57). 1882; Baker, Handb. Irid. 157. 1892, Fl. Cap. 6: 73. 1896; Foster, Contr. Gray Herb. 135: 60–61. 1941. TYPE: South Africa. Cape: "Rivierzondereinde," Swellendam, *Ecklon & Zeyher* 3967 (90.9) (as *Drège* 3969) (holotype, B "Herb. Lubeck"; isotypes, B, FI, G, K, S, SAM, W, Z).

Plants tiny, 2.5–4(–8) cm high. *Corm* narrowly ovoid, asymmetric, with an oblique flat side, 3–5 mm diam., tunics pale, concentric, drawn into bristles above. *Cataphyll* pale, membranous. *Leaves* (3–)4–6, usually all basal, or uppermost inserted on the lower part of the stem, flat, half as long, to slightly longer than the stem, 1–2 mm wide, linear-ensiform. *Stems* erect, single, or to 4, produced from near the base, rarely branched above. *Spike* 1–2(–3)-flowered; *bracts* 4–6 mm long, green, sometimes red along the margins. *Flowers* tiny, stellate, white, red-brown on the reverse of the outer tepals; *perianth tube* 1–2.5 mm long, nearly cylindric; *tepals* obovate, 3–6 (–8) mm long. *Filaments* ca. 2 mm long; *anthers* 1.2–1.8 mm long. *Ovary* ca. 2 mm long; *style* dividing at mid-anther level, branches less than 1 mm long, recurved. *Capsule* 4–6 mm long, obovoid, usually slightly exceeding bracts. *Chromosome number*, $2n = 26$ (*Goldblatt* s.n. no voucher, near Swellendam).

Flowering time. September to early October.

Distribution. Clay flats and slopes in renosterbosveld, in the Caledon district and eastwards to Heidelberg. Figure 24.

Geissorhiza nana is a very dwarf species of *Geissorhiza* clearly related to the southern and eastern Cape *G. bracteata*. It is in fact difficult to distinguish depauperate forms of the latter from *G. nana*. The flower is critical in separating the two: *G. nana* has tiny flowers with tepals 3–6 mm long, with very pronounced darker markings on the reverse of the outer tepals, while *G. bracteata* usually has quite large flowers with tepals in the 8–12 mm long range, and coloring on the reverse of the outer tepals is rare. Difficulties are, however, experienced in distinguishing *G. nana* from the depauperate forms of *G. bracteata* found in the southern Cape, which may have tepals as short as 6–7 mm, but even these plants are usually larger than *G. nana*.

There is also the possibility of confusing *Geissorhiza nana* with *G. setacea*, another dwarf species of section *Weihea*. *Geissorhiza setacea* is very similar in general appearance, but it is larger in all features, having flowers with a tube ca. 6 mm long and tepals in the 8–12 mm range. *Geissorhiza setacea* grows on damp sandy flats along the western Cape coastal belt, whereas *G. nana* grows in drier clay soils in the southern Cape.

My impression is that *Geissorhiza nana* is not uncommon in renosterbosveld from the Caledon district east to Riversdale. The few collections

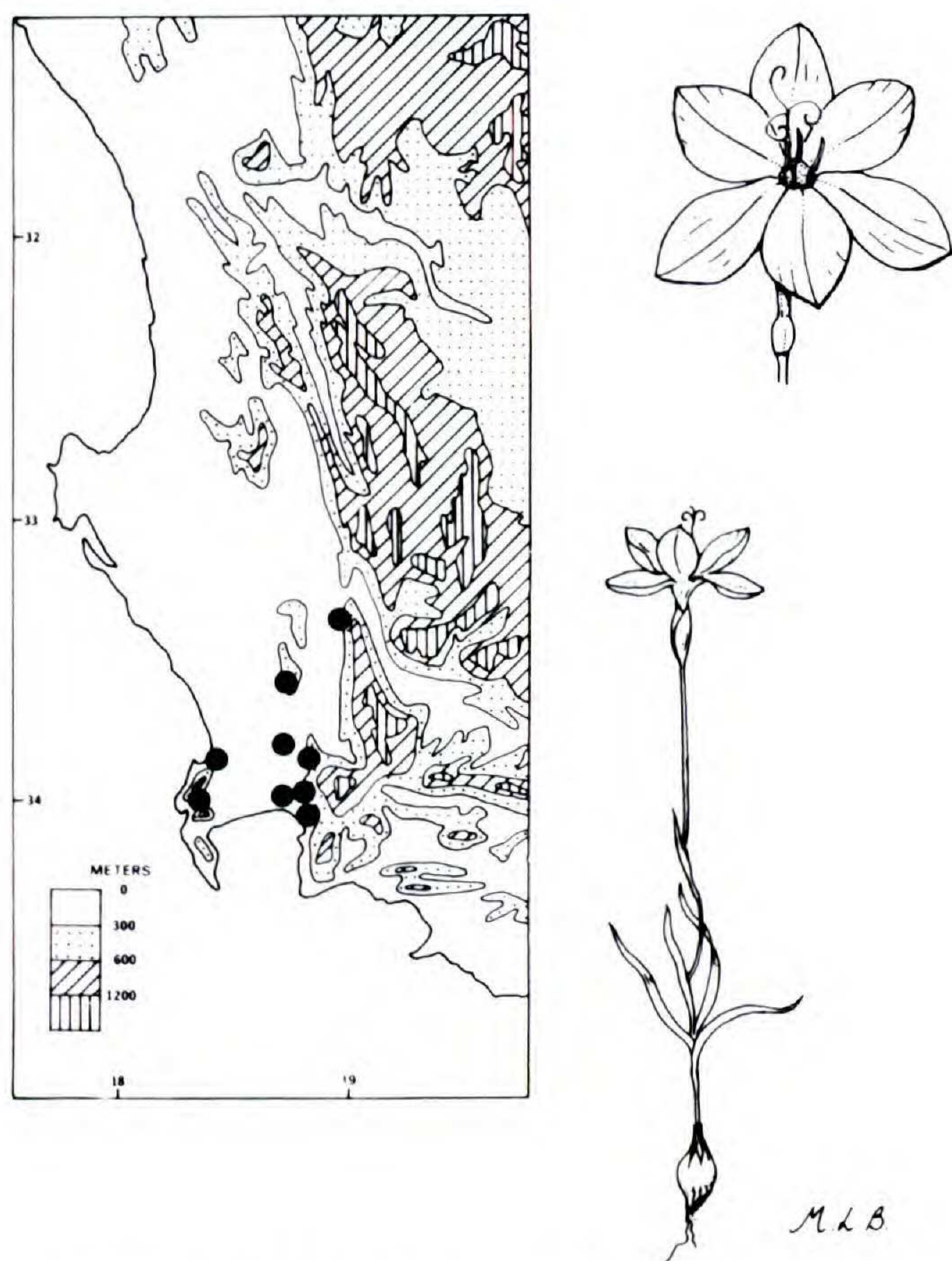


FIGURE 25. Morphology and distribution of *Geissorhiza setacea*. Habit $\times 0.5$; flower life size (Goldblatt 6193, flats near Gordons Bay).

of the species probably reflect the fact that it is very inconspicuous and thus easily overlooked.

Specimens examined. SOUTH AFRICA. CAPE: 3419 (Caledon) Drayton siding, E of Caledon (AB), Goldblatt 341 (BOL); Caledon, commonage S of the town, in clay gravel, Goldblatt 6198 (MO); turnoff to Speelmansrivier, E of Drayton near Caledon (BA), Oliver 6020 (STE); Riviersondereinde (BB), Ecklon & Zeyher 3967 (90.9) (B, FI, G, K, S, SAM, W, Z); clay flats near Mierkraal farm, SW of Bredasdorp (DB), Goldblatt 6185 (K, MO, NBG).

3420 (Bredasdorp) clay road verge between Heidelberg and Strawberry Hill (BB), Goldblatt 4961 (MO); Palmyra, Heidelberg, Loubser 2126 (NBG).

3421 (Riversdale) Korente River Dam, clay hill (AA), Bohnen 6663 (STE).

11. *Geissorhiza setacea* (Thunb.) Ker, Ann. Bot. (König & Sims) 1: 224. 1804, Bot. Mag. tab. 1255. 1810 (misapplied to *G. hispidula* Goldbl.); Baker, Fl. Cap. 6: 74. 1896, pro parte; Foster, Contr. Gray Herb. 135: 64. 1941. *Ixia setacea* Thunb., Diss. de *Ixia* no. 13: 146. 1783. TYPE: South Africa. Cape: without precise locality, Thunberg s.n. [lectotype, Herb. Thunb. 995, effectively designated by Foster (1941); isolectotypes, S

“Herb. Osbeck,” “Herb. Alstroemer,” “Herb. Montin”]. FIGURE 25.

Plants small, 4–8 cm high. *Corm* globose, asymmetric, one side flattened below and extending downward in a fan-like ridge, 3–4 mm diam., tunics concentric, outer layers irregularly fragmented. *Cataphyll* membranous. *Leaves* usually 4, the lower three basal, about half as long as stem, erect to falcate, linear-ensiform, 1–2.5 mm wide, lamina flat, the uppermost leaf cauline, usually smaller than the basal leaves, the lower half sheathing the stem. *Stem* erect, occasionally 1 or rarely 2-branched. *Spike* 1 (–rarely 2)-flowered; *bracts* 5–7 mm long, herbaceous, the upper margin sometimes reddish, the inner slightly longer than the outer. *Flower* hypocrateriform, cream white or pale yellow with a dark center, flushed red to purple on the reverse of the outer tepals especially with age; *perianth tube* ca. 6 mm long, infundibuliform; *tepals* (8–)10–12 mm long, obovate, 6–8 mm wide. *Filaments* 3–4 mm long; *anthers* 2.5–4 mm long. *Ovary* ca. 3 mm long; *style* dividing at the apex of the anthers, branches recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. July to August (to September).

Distribution. Wet flats in the southwestern Cape from the Peninsula east to the foot of the Hottentots Holland Mountains and north to Gouda. Figure 25.

This small species can easily be recognized by its fairly large, and relatively long-tubed flowers borne singly on short stems. Its corm tunics are of the concentric type, and it belongs in subgenus *Weihea*, near *Geissorhiza bracteata* and *G. nana*. *Geissorhiza setacea* can readily be distinguished from these species by its large flower, with tepals 8–12 mm long, on a very small plant seldom exceeding 8 cm in height. The very dwarf *G. nana* is similar but smaller, usually only 4–5 cm high and has tiny flowers with tepals 3–6 mm long. It is typical of clay soils in contrast to *G. setacea* which grows on damp and often waterlogged sandy flats.

It was one of the early species of *Geissorhiza* to be named, having been described by Thunberg in 1783, as *Ixia setacea*, from material he collected during his travels at the Cape in the years 1772–1775. It has generally been recognized as a distinct species of *Geissorhiza*, although partly confused with *G. bracteata* by J. G. Baker (1896)

and Foster (1941), both of whom included specimens of *G. bracteata* under *G. setacea*. This confusion is understandable as depauperate forms of *G. bracteata* do resemble *G. setacea*. The plant illustrated by Ker (1810) as *G. setacea* in the Botanical Magazine tab. 1255 is *G. hispidula* Goldbl. (*G. humilis* var. *bicolor* Baker), a different and not very closely related species.

Geissorhiza setacea usually has white flowers, but in the north of its range, near Gouda, at Elandsberg farm there is a creamy yellow form, which has a blackish center. This form grows sympatrically with and blooms at the same time as *G. purpureolutea* which has almost identical flowers, but imbricate corm tunics and ribbed leaves and belongs in subgenus *Geissorhiza*. This is one of several examples of floral convergence found in *Geissorhiza*, where similar flower color and marking occur repeatedly in unrelated species or in other genera.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) near Cape Town (CD) *H. Bolus* 4804 (BOL), 4803 (E, K, Z); Table Mt. near Orange Kloof, *Schlechter* 412 (Z); flats near Hoorn Kloof, Paardeberg, *Lewis & Salter* 3556 (BM, BOL, K); near Stellenbosch (DD), *Duthie* 521 (BOL); Stellenbosch, Golf Course, *Strey* 551 (PRE); Stellenbosch flats, *Garside* 279 (K), *Bos* 323 (PRE, WAG); outside Duthie Reserve, Stellenbosch, *Bos* 328 (STE); clay slope 300 ft. N of Bottelary Road, *Acocks* 2452 (S).

3319 (Worcester) Elandsberg farm, S of Gouda, wet flats (AC), *Goldblatt* 6210 (K, MO, NBG, PRE, S).

3418 (Simonstown) Van Der Stel, Stellenbosch (BB), *Smith* 3204 (PRE); low lying, wet area SW of Somerset West, *Boucher & Mauve* 4946 (PRE); sandy flats between Strand and Gordon's Bay, *Parker* 4227 (BOL, K, NBG), *Goldblatt* 6193 (K, MO, NBG); Faure, flats waterlogged in winter, *Parker* 3972 (BOL, K, NBG); Sir Lowrys Pass, *Stokoe s.n.* (SAM 49615), *Schlechter* 1154 (B, BM, G, Z).

WITHOUT PRECISE LOCALITY: Caledon, *Pappe s.n.* (SAM 55323); Cape, *Thunberg s.n.* (Herb. Thunb. 995 UPS, S), *Oldenberg* 489 (BM).

12. *Geissorhiza ornithogaloides* Klatt, Linnaea 34: 656. 1866. TYPE: South Africa. Cape: Caledon Zwartberg and about the Baths, *Ecklon & Zeyher Irid.* 225 (51.8) (lectotype, B, here designated; isolectotypes, B, BM, BOL, E, FI, G, GH, L, LD, MO, W, Z); Worcester, Tulbaghskloof, Winterhoekseberg, Tulbaghsthal etc., *Ecklon & Zeyher Irid.* 224 (77.9) (syntypes, B, LD, MO, S); Koue Bokkeveld, *Lichtenstein* 15 (syntype, B) [chosen arbitrarily by Foster as lectotype for *G. ornithogaloides*, being the first of the three cited type collections; it lacks a corm

and cannot be certainly identified and distinguished from *G. ornithogaloides* subsp. *marlothii* (syn. *G. marlothii*)]. FIGURE 26.

Plants small, 4–10 cm high. *Corm* either more or less ovoid or campanulate in outline with a broad flat base, 4–6 mm at widest diam., tunics medium brown, concentric, either fragmenting into elliptical sections or, in two parts, a campanulate cap and basal plate, then lower margins of cap toothed. *Cataphyll* membranous, often evidently lacking. *Leaves* usually 4, the lower two basal, linear to lanceolate, erect to falcate, 1–2 (–3) mm wide, flat, the upper two inserted on the stem at or above ground level, and sheathing below, the sheath often inflated. *Stem* erect, usually branching from both cauline leaves. *Spike* 1 (–rarely 2)-flowered; *bracts* pale green, becoming dry above, 7–10 mm long. *Flower* clear yellow, stellate; *perianth tube* 2–3 mm long, not exerted from the bracts; *tepals* obovate (6–)7–12 (–18) mm long, 3.5–6 mm wide. *Filaments* 2–4 mm long, erect; *anthers* 3–4.5 mm long, yellow. *Ovary* ca. 2 mm long, *style* dividing at the apex of the anthers, branches 2–3 mm long and recurved. *Capsule* obovate, 7–9 mm long, usually exceeding bracts. *Chromosome number*, $2n = 26$ (*Goldblatt* 214 as *G. nana*).

Flowering time. Late August to October.

Distribution. Sandy and clay flats and slopes from the Paarl district eastward through the Cold Bokkeveld, Worcester district and southern Cape to the Long Kloof. Figure 26.

Geissorhiza ornithogaloides is typically a dwarf and rather slender species with unusual, bright yellow flowers. It is morphologically variable and some plants in a population may be robust and much larger flowered than others, e.g., *Lewis* 6052, and the extremes almost seem different species. The vegetative morphology is however, remarkably uniform, with plants always having spikes with either one or two flowers, two narrow, flat, basal leaves, and two cauline and partly sheathing leaves.

This pattern is found in *Geissorhiza marlothii*, a species which is identical to *G. ornithogaloides* in all features except the corm, the reason that Foster (1941) recognized the former as distinct. *Geissorhiza marlothii* has a small corm with concentric tunics of the type characteristic of all species of subgenus *Weihea*. The corm of *G. ornithogaloides* is unusual in the genus, being campanulate in outline, with an oblique flat base and

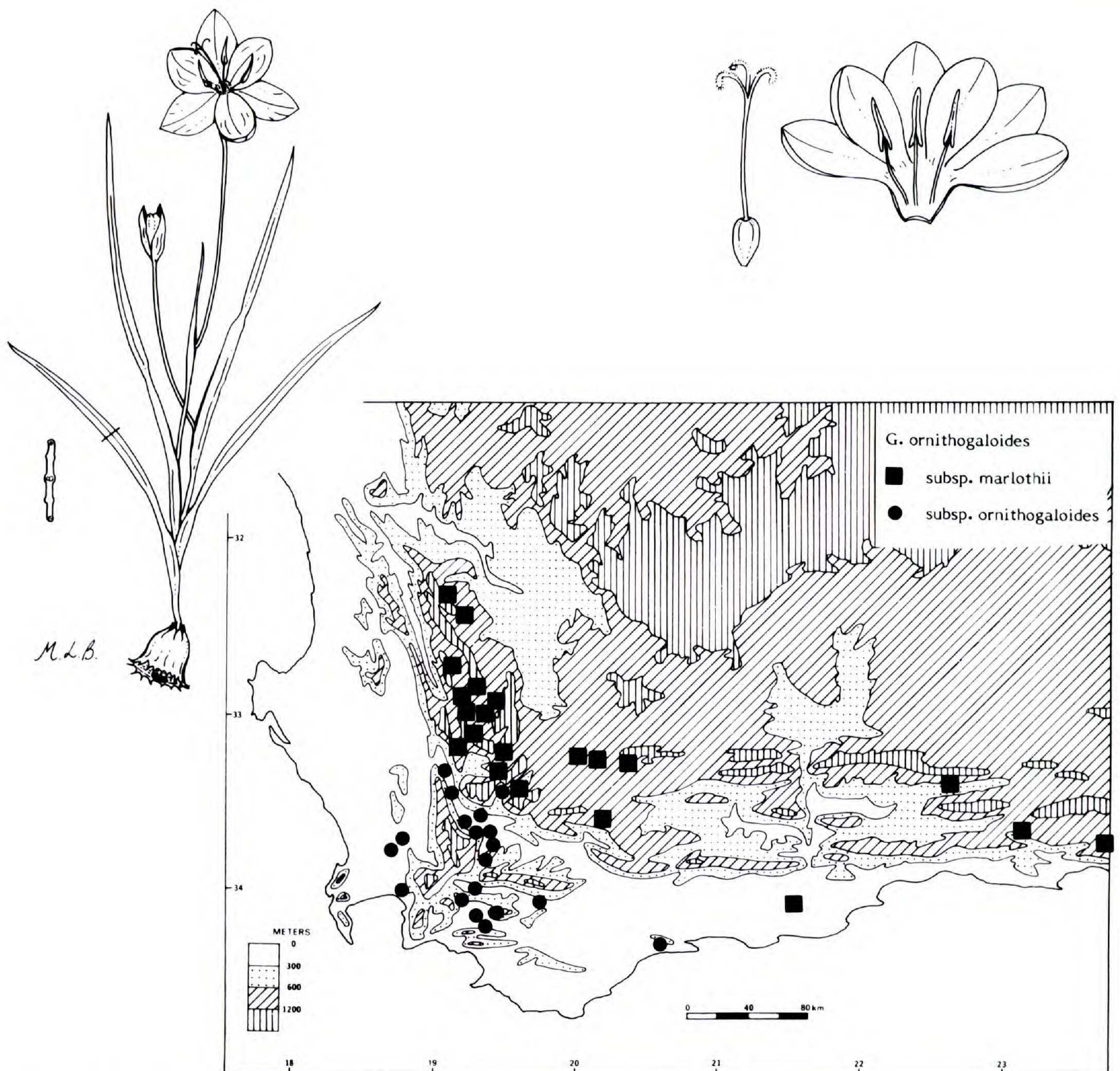


FIGURE 26. Morphology and distribution of *Geissorhiza ornithogaloides*. Habit with flower life size; opened flower and gynoecium $\times 2$ (Goldblatt 6202, Villiersdorp-Brandvlei).

serrate lower margins. The morphological similarity between the two species, excepting the corms, seems to me so striking, however, that I prefer to treat *G. marlothii* as a subspecies of *G. ornithogaloides*.

The only close ally of *Geissorhiza ornithogaloides* is *G. malmesburiensis*, described by Foster in 1941 on the basis of a single Schlechter collection, which lacked corms. A second sheet of the Schlechter collection, and collections made by Lewis and by myself, have corms which are exactly like those of the typical subspecies of *G. ornithogaloides*, which substantiates Foster's belief that they were in fact closely related. *Geissorhiza malmesburiensis*, in fact, differs from all

forms of *G. ornithogaloides*, mainly in its large flower size which contrasts with its very dwarf vegetative morphology.

I have found it necessary to alter the lectotypification of *Geissorhiza ornithogaloides*, the reasons being as follows. Of the three collections cited by Klatt in the protologue, two are Ecklon and Zeyher collections from the Caledon district, both widely well-distributed in major herbaria, and often complete with corms. The first specimen cited, however, is a Lichtenstein collection supposedly from the Cold Bokkeveld which today lacks corms, though they were present at one time according to the description. Both the distribution and description of the corms suggests

that this last collection is *G. marlothii*, yet was chosen as lectotype by Foster, for *G. ornithogaloides*, a species only distinguishable from *G. marlothii* by its corms. Foster was clearly arbitrary in choosing this first cited collection as lectotype, and I propose in place *Ecklon & Zeyher Irid. 225* in the Berlin Herbarium as the lectotype. The present interpretation of *G. ornithogaloides* is in this way preserved.

The two subspecies of *Geissorhiza ornithogaloides* are treated below, with subsp. *marlothii* first, as it is clearly the less specialized, having corms of the basic type for the subgenus, whereas corms of subsp. *ornithogaloides* are unusual and must be regarded as derived.

KEY TO THE SUBSPECIES OF
GEISSORHIZA ORNITHOGALOIDES

- 1a. Corm nearly ovate, tapering at both ends, not campanulate in outline; and lower margins of tunics not or rarely slightly serrate subsp. *marlothii*
- 1b. Corm campanulate with an oblique flat base; the lower margins of the tunics serrate subsp. *ornithogaloides*

12A. Subsp. *marlothii* (Foster) Goldbl., comb. et stat. nov., *Geissorhiza marlothii* Foster, Contr. Gray Herb. 135: 66. 1941. TYPE: South Africa. Cape: Cold Bokkeveld, Houdenberg, 850 m, *Marloth 10612* [holotype, B; isotypes, PRE, STE (without corms)].

? *Ixia ornithogaloides* Licht. ex Roem. & Schult., Syst. Veg. 1: 376. 1817. TYPE: South Africa. Cape: Koue Bokkeveld, *Lichtenstein 15* (holotype, B). (Specimens lack corms needed to distinguish the species from *G. ornithogaloides* Klatt, but from the stated locality, must be subsp. *marlothii*. This is not the basionym of *G. ornithogaloides* Klatt.)

Corm nearly ovoid, tapering at both ends, obliquely flattened below on one side, sometimes with the flat part extending downward conspicuously, 3–5 mm diam., tunics concentric, fragmenting vertically into elliptical segments. **Flowers** sometimes very small, with *tepals* (6–)7–12 (–15) mm long. **Filaments** 2–4 mm long; **anthers** 3–4 mm long. **Chromosome number**, unknown.

Flowering time. Late August to October.

Distribution. Sandy and shale slopes and flats, Cold Bokkeveld, and east through the Warm Bokkeveld and the Witteberg and Voetpadsberg, with outlying disjunct populations in the Little Karoo, the Albertinia district and Long Kloof in the southern Cape. Figure 26.

Subspecies *marlothii* has an ovate-elliptic corm with concentric tunics. This corm is typical of subgenus *Weihea* and must be viewed as the ancestral type in *G. ornithogaloides*, while the campanulate corm of subsp. *ornithogaloides* is specialized and derived. In all other features, the two subspecies are essentially identical, although there are several populations of subsp. *marlothii* on the edges of the range of this subspecies that have smaller flowers than any found in subsp. *ornithogaloides*.

The smaller flowered collections are those to the north and east of the main range for subsp. *marlothii*, which is centered in the Cold and Warm Bokkeveld. The northern extension is represented by a collection from the Koudeberg near Wuppertal (*Schlechter 8749*) and the eastern extension by collections from the Witteberg (e.g., *Compton 3806*) and from apparently disjunct populations in the Little Karoo, Albertinia district (southern Cape) and in the Long Kloof. The eastern populations are few and scattered and subsp. *marlothii* is apparently rare outside its main range. There is nothing as yet known to suggest that these eastern populations represent a distinct taxon as they are similar to several flowered plants from other localities, notably to the *Schlechter* and *Compton* collections mentioned above.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Koudeberg, Wuppertal (AC), *Schlechter 8749* (B, BM, BOL, BR, E, G, H, K, L, MO, PH, PRE, S, Z); Houdenberg, Cold Bokkeveld (AD), *Marloth 10612* (B, PRE, STE), Cold Bokkeveld, 3 mi. S of Leeurivier (CC), *Lewis 2637b* (SAM); Bokkeveld Tafelberg (CD), *Leighton s.n.* (BOL); Cold Bokkeveld, flats at De Keur, *Esterhuysen 13006* (BOL, PRE); Schoongesig, Ceres, *Hanekom 1222* (K, PRE, STE).

3319 (Worcester) 7 mi. W of Gydo Pass, Cold Bokkeveld (AA), *Hutchinson 1055* (K, NBG); Gydo, Ceres (AB), *Leipoldt 3811* (BOL); 6 mi. N of the top of Gydo Pass, *Lewis 2637a* (SAM); Groenfontein, *Barker 3115* (NBG); between Loch Lynne and Winkelhaak, *Oliver 5120* (K, MO, PRE, S, STE); Lakenvlei (BC), *Olivier s.n.* (NBG 60692); Theron's Pass, *De Vos 1673* (STE); Orchard Siding, Worcester, *Rogers 16570* (K), 16666 (K).

3320 (Montagu) poort N of Pienaarskloof, Ceres Div. (AA), *Acocks 23700* (PRE); Voetpadsberg, *Barker 7497* (NBG); Elandsfontein, Witteberg (AD), *Compton 3806* (BOL, NBG); farm Rietvlei, off Ouberg Pass, N of Montagu (CA), *Perry 1674* (NBG).

3321 (Ladismith) Swartberg Mts., Gamka Nature Reserve (BC), *Vlok 314* (MO).

3323 (Willowmore) Avontuur-George road, farm Arbor Nook, Pootjiesrivierhoogte (CA), *Snijman 361* (NBG).

3324 (Steytlerville) Company's Drift, Long Kloof (CC), *Fourcade 2313* (BOL, K, STE).

3421 (Riversdale) *Albertinia* (BA), *Erasmus* 1578 (STE), 1624 (STE); Plattebosch, near *Albertinia*, *Muir* 1810 (BOL).

WITHOUT PRECISE LOCALITY: Ceres Wild Flower Show, *Lewis* s.n. (BOL 21246).

12B. Subsp. *ornithogaloides*. FIGURE 26.

Geissorhiza flava Reichb. ex Klatt, Abh. Naturf. Ges. Halle 12: 392 (Erg. 58). 1882. TYPE: South Africa. Cape: without precise locality, *Breutel* s.n. (holotype, B).

Waitzia flava Reichb. ms., Klatt, Abh. Naturf. Ges. Halle 12: 392. 1882, in syn.

Geissorhiza ornithogaloides var. *flava* (Klatt) Foster, Contr. Gray Herb. 135: 68. 1941.

Geissorhiza romuleoides Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 27. 1827, nom. nud. et ms. [*Ecklon & Zeyher Irid.* 225 (51.8)].

Corm campanulate with an obliquely flattened base, 4–6 mm at widest diam., *tunics* medium brown, concentric, in two parts, with a cap, and separate basal disc, lower margins of cap serrate. *Flowers* with tepals 8–12(–18) mm long. *Filaments* 2.5–4 mm long; *anthers* 3–4.5 mm long. *Chromosome number*, $2n = 26$ (*Goldblatt* 214 as *G. nana*).

Flowering time. September to October.

Distribution. Clay and sandy flats and slopes from the Paarl district east to Worcester and the Hex River Valley and south to the Caledon district. Figure 26.

As already discussed, subsp. *ornithogaloides* differs from subsp. *marlothii* only in its corms. The corms of subsp. *ornithogaloides* are campanulate with a flat base, and have a serrate lower margin. Subspecies *marlothii* has ovate-elliptic corms, tapering at both ends, a type found in most species of subgenus *Weihea*. In other features, the two subspecies are essentially identical, except that some populations of subsp. *marlothii* have smaller flowers than any found in subsp. *ornithogaloides*.

Geissorhiza flava Klatt is a name applicable to larger flowered, robust forms of *G. ornithogaloides*, and although corms are lacking from the type, it most likely is synonymous with subsp. *ornithogaloides*. Foster (1941) reduced *G. flava* to varietal rank, distinguishing it as being somewhat larger and usually 2-branched. As he comments, it tends to intergrade with the typical variety. With the considerably greater number of collections available to me, it seems clear that even this treatment is unacceptable. Variation within populations of *G. ornithogaloides* can be

considerable and robust plants corresponding to *G. flava* may grow next to small slender individuals matching the lectotype of *G. ornithogaloides* (e.g., *Lewis* 6052).

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) near Hercules Pillar (DD), *Salter* 4721 (BM, BOL, K), *Mathews* s.n. (Nat. Bot. Gard. 1419/30 in BOL); Agter Paarl, *Barker* 404 (NBG).

3319 (Worcester) Romansrivier (AC), *Lewis* 2638 (SAM); Romans River Nature Reserve, *Goldblatt* 6290 (MO, WAG); Buffelsrug, Osplaats Station, NE of De Doorns (BC), *Mauve & Oliver* 235 (STE); Brandvlei, sandy flats near the water (CB), *Lewis* 6052 (NBG, STE); Du Toits Kloof-Stettyns Kloof, *Barker* 9454 (NBG); E end of Du Toits Kloof, sandy flats, *Lewis* 6043 (NBG, S), *Goldblatt* 2412 (MO, NBG, S); between Du Toits Kloof and the Breede River on stony roadside, *Goldblatt* 4703 (MO, NBG); road from Villiersdorp to Worcester (CD), *Goldblatt* 205 (BOL), *Barker* 7540 (NBG); S slope of Quaggasberg, *Mauve & Oliver* 264 (STE); between Brandvlei and Villiersdorp, *Goldblatt* 6202 (MO, PRE, S, WAG).

3418 (Simonstown) sandy flats between Gordons Bay and Strand (BB), *Parker* 4241 (GH, NBG, K).

3419 (Caledon) between French Hoek and Villiersdorp (AA), *Lewis* 2898 (SAM); Sondereinde River bridge on Villiersdorp-Caledon road (AB), *Salter* 4792 (BOL, K); Caledon, *Leipoldt* s.n. (BOL); Caledon, Zwartberg and about the Baths, *Ecklon & Zeyher Irid.* 225 (51.8) (B, BM, BOL, E, FI, G, GH, L, LD, MO, S, W, Z); Zwartberg, Caledon, *Zeyher* 3966 (B, FI, G, K, SAM); commonage below Zwartberg, Caledon, *Guthrie* s.n. (BOL 16917); hillside above vlei, Caledon road 1 mi. from Villiersdorp turnoff, *Barker* 13 (BOL, K); stony flats S of Villiersdorp at Theewater farms turnoff, *Goldblatt* 4016 (MO); road from Shaws Pass to Caledon (AD), *Goldblatt* 214 (BOL); Onverwacht, 19 mi. W of Riviersonderend (BA), *Acocks* 22665 (PRE).

3420 (Bredasdorp) Potberg flats, De Hoop Nature Reserve (BC), *Burgers* 2248 (STE).

WITHOUT PRECISE LOCALITY: Cape, *Breutel* s.n. (B "Herb. Lubeck").

13. *Geissorhiza malmesburiensis* Foster, Contr. Gray Herb. 135. 1941. TYPE: South Africa. Cape: hill near Malmesbury, 300 m, *Schlechter* 1654 (holotype, B; isotypes, B, BOL, BR, L, MO, PRE, Z). FIGURE 27.

Plants small, 5–8 cm high. *Corm* campanulate with an oblique flat base, 4–6 cm at widest diam., *tunics* medium brown, concentric, in two parts, a campanulate cap and basal plate, the lower margins of the cap toothed. *Cataphyll* membranous, evidently often lacking. *Leaves* usually 4, the lower two or three basal, linear-filiform, more or less erect, to 1 mm wide, blade plane, the upper two or uppermost inserted on the stem at or above ground level, sheathing and inflated

below, narrow above. *Stem* erect, simple or branching from the upper leaf or leaves. *Spike* 1-flowered; *bracts* pale green, with a hyaline margin, becoming dry above, 7–11 mm long. *Flower* clear yellow, cupped; *perianth tube* ca. 4 mm long, included in the bracts; *tepals* obovate, 13–25 mm long, to 8 mm wide. *Filaments* ca. 6 mm long, erect; *anthers* 4–5 mm long, yellow. *Ovary* ca. 3 mm long, *style* dividing at the apex of the anthers, branches ca. 4 mm long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (Goldblatt 6282).

Flowering time. September to early October.

Distribution. Restricted to the Malmesbury district. Figure 27.

When Foster (1941) described this species from a single sheet of a Schlechter collection, he was unaware of the nature of its corm. A second sheet of the type collection also at Berlin Herbarium has several corm fragments, while the only other collections of *Geissorhiza malmesburiensis*, made by Lewis in 1952 and by myself in 1981, have intact corms, and it is now clear the species has the striking corm previously thought restricted to *Geissorhiza ornithogaloides* (here subsp. *ornithogaloides*). The corm is campanulate in outline with an oblique flat base, and toothed lower margins. The corm structure bears out Foster's suggestion that *G. malmesburiensis* is closely related to *G. ornithogaloides*. The two in fact differ mainly in the size of the floral parts. *Geissorhiza malmesburiensis* has flowers much larger than any known in *G. ornithogaloides*, although all plants so far collected are rather small, slender, and few branched. Flowers of *G. malmesburiensis* have a perianth tube ca. 4 mm long and tepals 13–25 mm long but usually in the 20–25 mm range, while in *G. ornithogaloides* the perianth tube is 2–3 mm long and the tepals (6–)7–15 mm long, rarely to 18 mm, and robust plants with larger flowers are always branched and have spikes of more than one flower each.

This species is evidently extremely rare. The only known habitat, on the slopes above Malmesbury, is being developed for housing, and this population will soon be extinct. *Geissorhiza malmesburiensis* may occur elsewhere in the Malmesbury district, but collecting in this heavily agricultural area has so far failed to produce other records of the species. It must be regarded as seriously endangered and if not extinct, then on the verge of extinction.

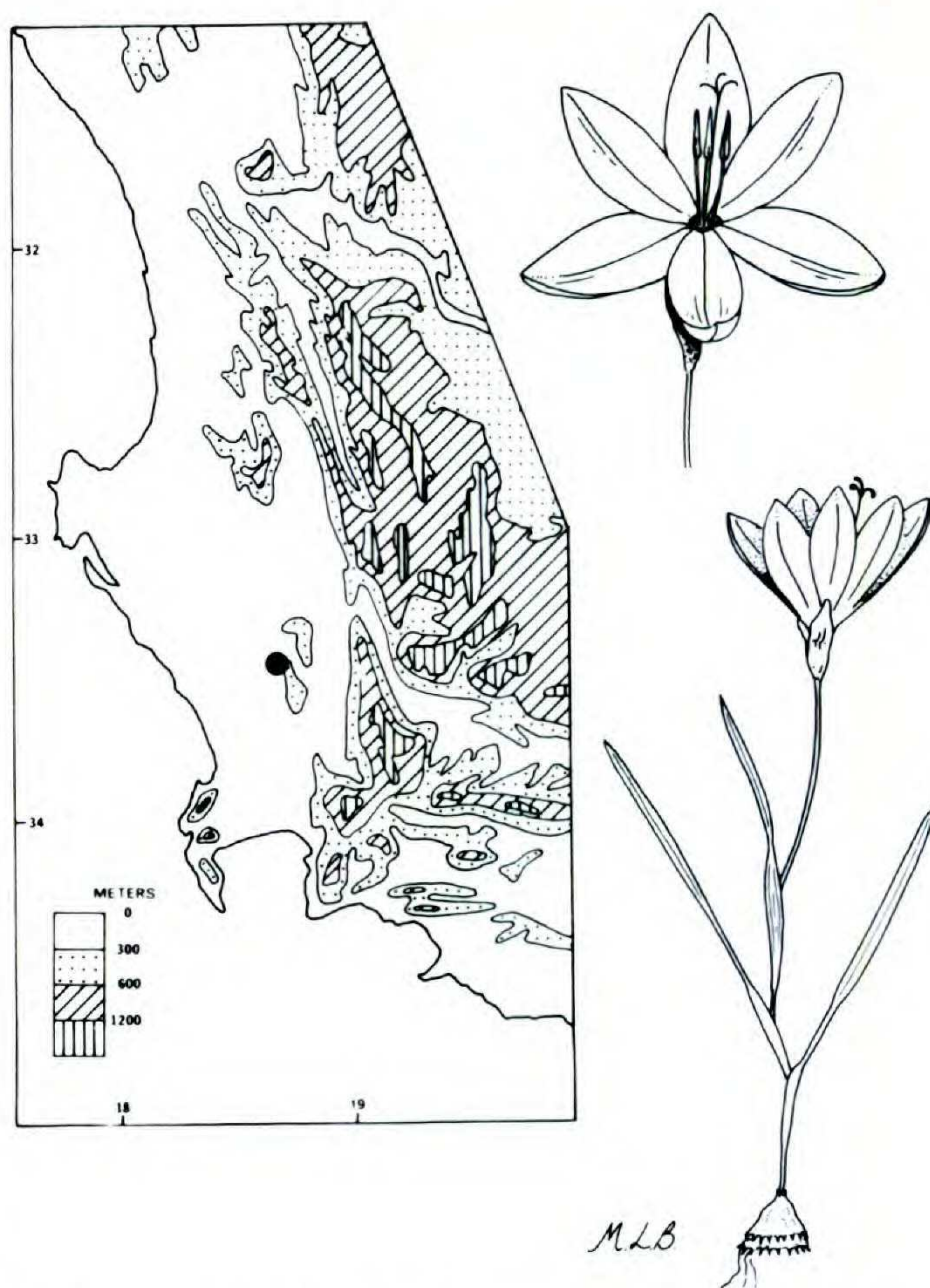


FIGURE 27. Morphology and distribution of *Geissorhiza malmesburiensis*. Habit life size; separate flower $\times 2$ (Goldblatt 6282, Malmesbury Commonage).

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Malmesbury commonage (BC), Lewis 3633 (SAM), Goldblatt 6282 (MO); hill near Malmesbury, 300 m, Schlechter 1654 (B, BOL, BR, L, MO, PRE, Z).

14. *Geissorhiza geminata* E. Meyer ex Baker, Handb. Irid. 159. 1892, Fl. Cap. 6: 76. 1896; Foster, Contr. Gray Herb. 135: 63. 1941. TYPE: South Africa. Cape: between Slangenheuwel, Franschehoek and Donkerhoek, Drège s.n. "*G. geminata* EM. α " (lectotype, K, designated here; isolectotypes, B, BM, E, G, K, L, MO, P, S) [Foster (1941) failed to indicate which of the sheets at K was the "type" hence his apparent lectotypification cannot be accepted]. FIGURE 28.

Geissorhiza geminata Drège ms.; E. Meyer, Flora 26 (Beigabe): 119–187. 1844, nom. nud.

Plants (12–)16–30 cm high. *Corm* globose, more or less symmetric, obliquely flattened below, tunics concentric, light brown, fragmenting irregularly into segments, drawn into short bristles above. *Cataphyll* membranous. *Leaves* 3–5,

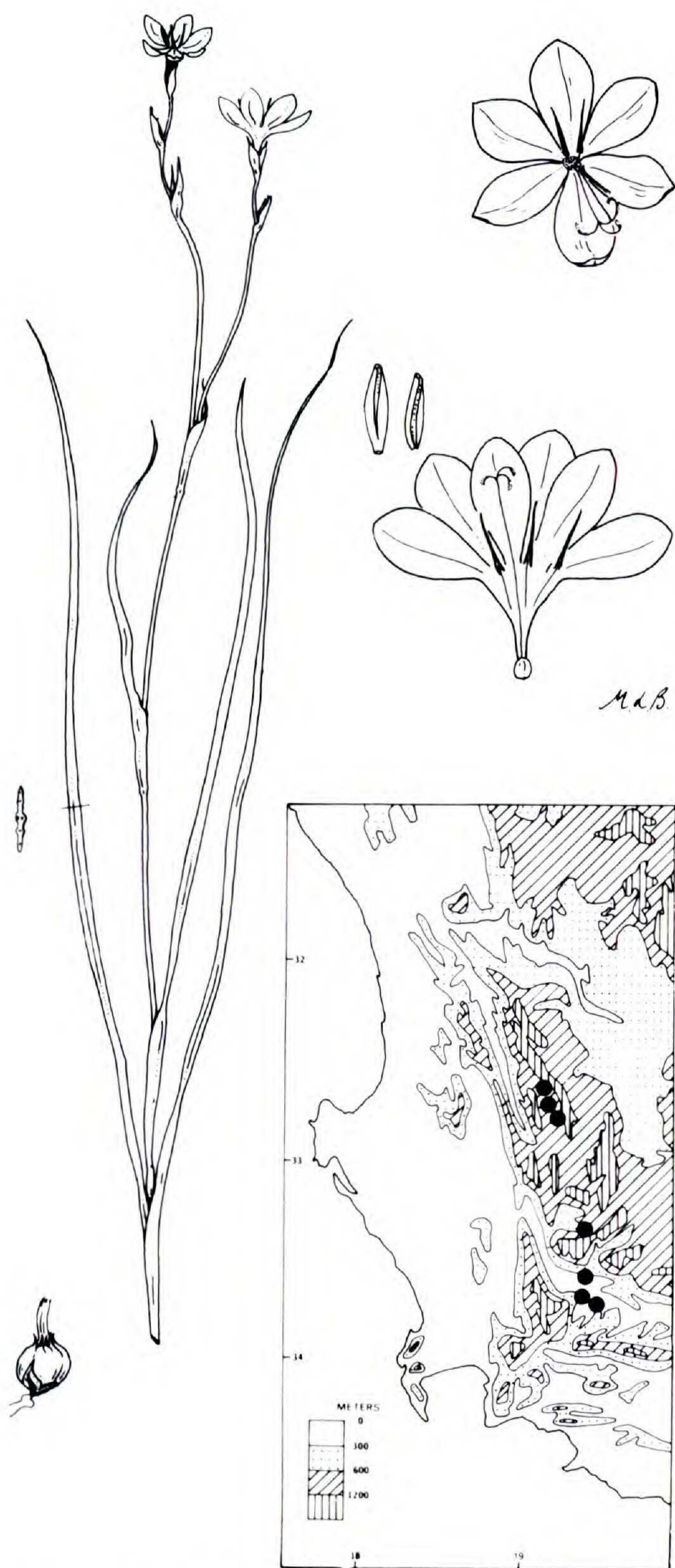


FIGURE 28. Morphology and distribution of *Geissorhiza geminata*. Habit and corm $\times 0.5$; intact and opened flower and floral bracts life size; leaf section much enlarged (Goldblatt 6981, flats near Worcester).

the lower two or three basal, shorter than the stem, 1–2 mm wide, blade plane when dry, possibly inflated and terete when live in some populations, the upper leaves cauline and partly sheathing, uppermost bract-like, often vestigial. Stem erect, bearing leaves below and leafy bracts above, often branched and then dichotomously.

Spike 1–3-flowered; bracts herbaceous, hyaline or reddish along the margins, 6–8 mm long, the inner about as long, or longer than the outer. Flower white (to cream), stellate, sometimes pink on the reverse of the tepals; perianth tube to 8 mm long, reaching the apex of the bracts or longer; tepals to 14 mm long, ca. 6 mm wide. Filaments to 4 mm long, erect; anthers 5 mm long. Ovary 1.5–3 mm long, style dividing at the apex of the anthers, branches ca. 4 mm long, recurved. Capsule unknown. Chromosome number, unknown.

Flowering time. September to November.

Distribution. Marshes and vleis, in sandy areas from Brandvlei north to the Cold Bokkeveld. Figure 28.

Geissorhiza geminata is a semi-aquatic species, typically found in seasonally marshy areas, sometimes in standing water. It occurs in the Worcester and Ceres districts, north into the Cold Bokkeveld. It is often confused with the superficially similar *G. brehmii* (syn. *G. teretifolia*) which also grows in aquatic habitats and has fairly large white flowers. The two species are, however, quite unrelated. *Geissorhiza brehmii* has imbricate corm tunics typical of subgenus *Geissorhiza*, while *G. geminata* has the concentric tunics of subgenus *Weihea*. *Geissorhiza geminata* is most probably allied to *G. setacea* and *G. ornithogaloides* (section *Weihea*), and it has the flat leaf lamina characteristic of the section. It can be distinguished by its large white flower, long perianth tube usually exserted from the bracts and also by its characteristic pattern of nearly dichotomous branching in the upper stem. This branching pattern is so distinctive that most specimens of *G. geminata* can be recognized at once from this character alone.

The name *Geissorhiza geminata* was first used by Drège on his collections of the species and the name was subsequently published by Meyer (1843) in this treatise on Drège's travels and collections. A valid description was not published until 1892 by J. G. Baker. Earlier, Vahl (1805) described an *Ixia geminata*, which is according to Lewis (1962), synonymous with *G. geminata*. It is not, however, the basionym for *G. geminata* which was treated as a new name in *Geissorhiza*. The identity of Vahl's *Ixia geminata* is unknown to me. The type specimen in the Vahl Herbarium has been lost, although a sheet, now bearing only the faint impression of a plant, still exists.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cold Bokkeveld, vlei at Leeurivier bridge (CC), *Horrocks* 37 (NBG); Skoongesig, Cold Bokkeveld, *Hanekom* 1269 (PRE); between Groot River and Elands Kloof, *Leipoldt* 3036 (BOL), 3038 (BOL).

3319 (Worcester) near Lakenvlei (BC), *Phillips* 2077 (SAM); Brandvlei (CB), *Lewis s.n.* (BOL 20414, K); near Worcester, in water, *L. Bolus s.n.* (BOL 19180), *Goldblatt* 6981 (E, K, MO, NBG, PRE, S, US, WAG); Moordkuil, Worcester (CD), *Lewis* 2896 (SAM); Scherpenheuvel vlei (DA), *Barker* 7507 (NBG).

WITHOUT PRECISE LOCALITY: between Slangenheuvel, Franschehoek and Donkerhoek, *Drège s.n.* "*G. geminata* EM. α " (B, BM, E, G, K, L, MO, P, S); Cape of Good Hope, *Heatley* 6394 (BM).

15. *Geissorhiza ovalifolia* Foster, Contr. Gray Herb. 135: 58. 1941. TYPE: South Africa. Cape: "Drakensteinsbergen, 4,000–5,000 ft., Oct.," *Drège s.n.* (holotype, B; isotypes, G, S).

Plants small, 3–7(–9) cm high. *Corm* ovoid, 2 mm diam., tunics concentric, papery and soft. *Cataphyll* evidently dark, membranous or becoming fibrous. *Leaves* 4–5, the lower three to four basal and prostrate, the uppermost cauline and bract-like, lanceolate-oblong, occasionally ovate, acute, 2–5 mm wide, 1–4 cm long, bearing a cormlet in the axil of one or more basal or rarely cauline leaf. *Stem* often prostrate near base, then erect, with a leaf bract in lower third to midline, rarely 1-branched. *Spike* 1–4(–6)-flowered, flexuose; *bracts* herbaceous, becoming membranous above, 4–7 mm long, the inner usually slightly shorter than the outer. *Flowers* stellate, white, yellow in the throat; *perianth tube* 2–3 mm long, widening from the base; *tepals* ovate, 6–8 mm long, to 3.5 mm wide. *Filaments* 2–3 mm long; *anthers* 1.5–3 mm. *Ovary* ca. 2 mm long, *style* dividing at the apex of the anthers, branches 1.2–2 mm long, recurved. *Capsules* ovoid, 3–5 mm long. *Chromosome number*, unknown.

Flowering time. Late September to mid-November.

Distribution. Mountains of the western Cape from French Hoek north to Visgat and the Twenty Four Rivers Mountains, usually in shaded sites in damp moss. Figure 29.

Geissorhiza ovalifolia is a poorly known mountain species of damp shady sites in mossy banks, cracks in cliffs and rocky ledges, or under boulders. It is often confused with the more widespread and common *G. bolusii* which occurs in similar habitats in the Cape mountains. *Geis-*

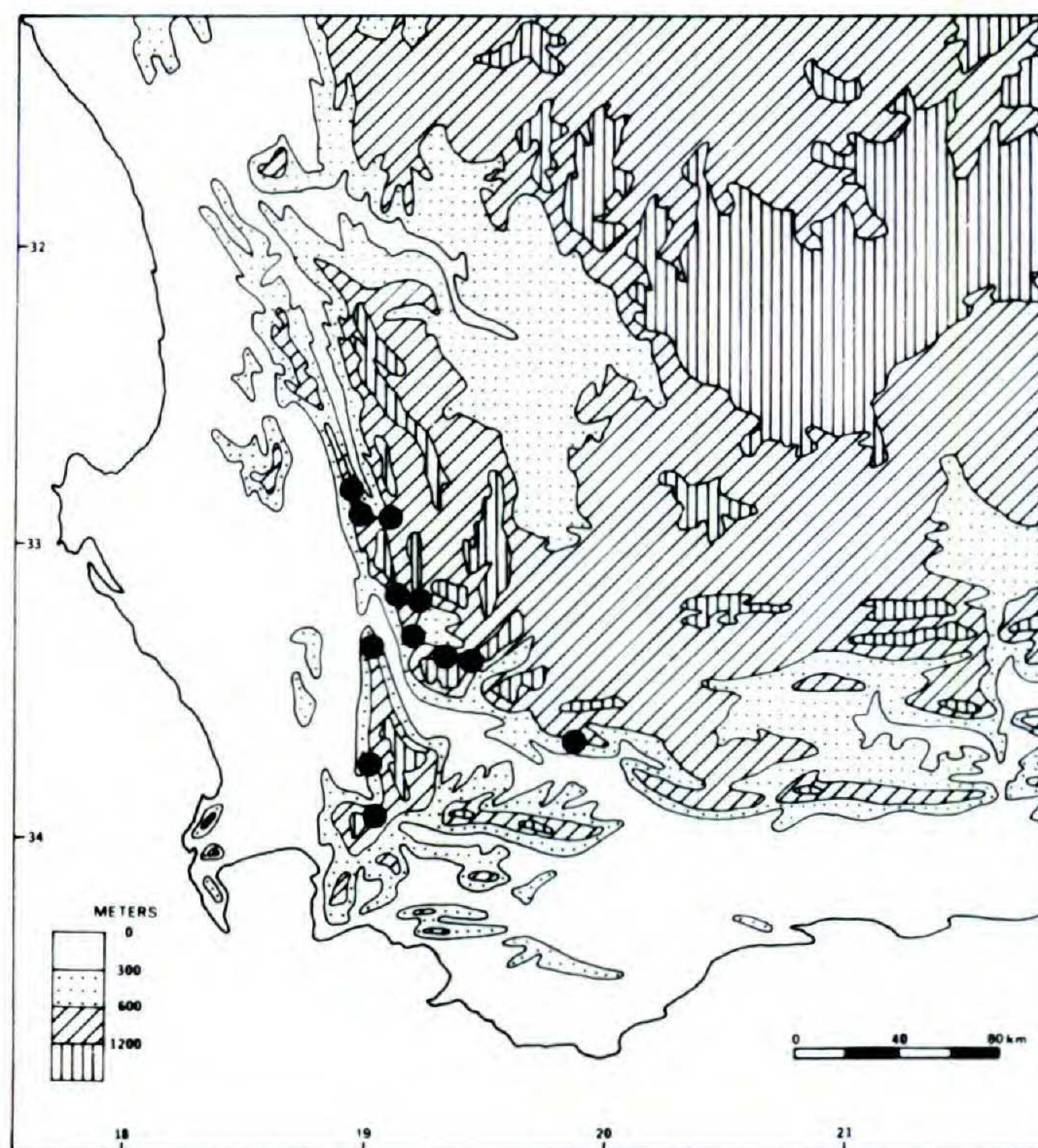


FIGURE 29. Distribution of *Geissorhiza ovalifolia*.

sorhiza ovalifolia is evidently sexually fertile, and capsules develop rapidly after blooming. Unfortunately, few mature plants are known. It also produces a cormlet in one or two basal or rarely cauline leaf axils which gives it a characteristic appearance. In contrast, *G. bolusii* is a triploid, sexually sterile species, and it produces cormlets in all basal and cauline leaf axils, and also in the fertile bract axils after flowering. The two can sometimes also be distinguished by the number of cauline leaf bracts, one being characteristic of *G. ovalifolia* while there are usually several in *G. bolusii*. This distinction does not always hold, and some specimens of *G. bolusii* may also have a single leaf bract on the stem.

In some specimens, the slightly darker yellow color in the perianth tube and throat gradually intensifies with age, and in the early nineteenth century collections of Drège, and Ecklon and Zeyher, it has turned dark blue. This has been the cause of some taxonomic confusion and Foster (1941) believed the dark center to be a significant taxonomic feature of *G. ovalifolia*.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Twenty Four Rivers Mts., damp shady spots (AA), *Esterhuysen* 16164 (BOL, PRE); Visgat, *Stokoe s.n.* (SAM 63131); Groot Winterhoek farm, mts. behind Porterville, *Boucher* 1902 (PRE, STE); near Porterville, *Edwards s.n.* (BOL); Witsenberg, Inkruip Ridge above De Eiker, *Esterhuysen* 33612 (BOL, K, MO, PRE, S, US); mts. W of Gydo Pass, *Hutchinson*

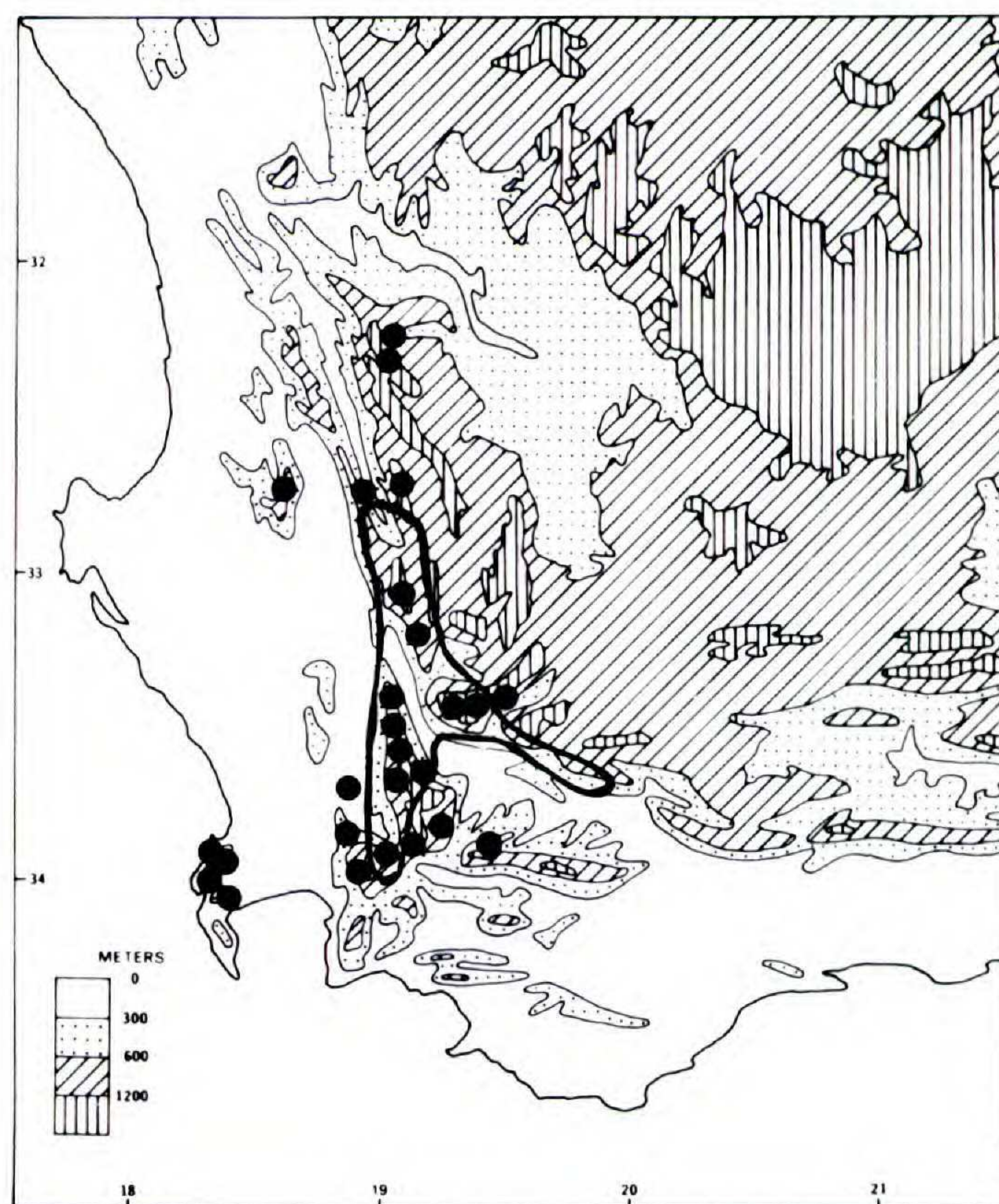


FIGURE 30. Morphology and distribution of *Geissorhiza bolusii* with the range of the closely allied, sexually fertile *G. ovalifolia* outlined. Flowering plant $\times 0.5$; sterile plant and flower life size (*Esterhuysen 35281A*, Simonsberg).

1013 (K); Hartebeeskloof, S slopes of Vaalboskloofberg (AB), *Oliver 5162* (STE); Worcester, "beim waterfall" (AC), *Ecklon & Zeyher Irid. 223* (B, FI, G, LD, MO, S); Hex River Mts., Milner Ridge Peak (AD), *Esterhuysen 9341* (BOL); Michells Pass, *Esterhuysen 6202* (BOL), *Compton 11934* (NBG); Ceres side of Michells Pass, *Thorne s.n.* (MO, SAM 51236); rugged slopes above Merweda, E of Eselfontein, *Esterhuysen 32678* (BOL, K, MO, PRE); French Hoek Forest Reserve near Bushmans Castle (CC), *Salter 6869* (BOL, SAM); Langeberg, above Berg-en-dal farm, ca. 2,000 ft., steep S facing slopes and cliffs (DB), *Esterhuysen 35683* (K, MO, NBG, PRE, WAG).

3419 (Simonstown) Helderberg, Somerset West (BB), *Dummer 590* (E).

WITHOUT PRECISE LOCALITY: Witsenberg, Tygerkloof, *Zeyher s.n.* (SAM 20889), *Drège s.n.* (B).

- 16. *Geissorhiza bolusii*** Baker, *Handb. Irid.* 158. 1892, *Fl. Cap* 6: 75. 1896; Foster, *Contr. Gray Herb.* 135: 57–58. 1941; Lewis, *Fl. Cape Penins.* 254. 1950. TYPE: South Africa. Cape: Du Toits Kloof, 2,300 ft., *H. Bolus s.n.* [lectotype, BOL 5247 in K, effectively designated by Foster (1941); isoelectotype, BOL]. FIGURE 30.

Geissorhiza rupestris Schltr., *Bot. Jahrb. Syst.* 27: 98. 1899; Foster, *Contr. Gray Herb.* 135: 57. 1941. TYPE: South Africa. Cape: mts. above Bains Kloof,

2,400 ft., *Schlechter 9167* [lectotype, B, designated by Foster (1941); isoelectotypes, B, BM, BOL, E, G, H, K, L, MO, PH, PRE, Z].

Geissorhiza dregei Baker, *Handb. Irid.* 158. 1892, *Fl. Cap.* 6: 74. 1896; Foster, *Contr. Gray Herb.* 135: 56. 1941. TYPE: South Africa. Cape: Paarl Mts., *Drège s.n.* "*G. secunda* β Ker α " [lectotype, K, effectively designated by Foster (1941); isoelectotypes, BM, E, G, K, L, MO]; without locality, *Thunberg s.n.* (syntype, Herb. Burman G = *G. parva*); Olifantshoek, *Ecklon & Zeyher Irid.* 221 (syntype, SAM = *G. parva*).

Geissorhiza tabularis Ecklon ms. (*Ecklon 311*).

Plants 3–8(–11) cm high. *Corm* more or less ellipsoid, 2–4 mm diam. at widest, tunics pale, concentric, brittle-papery, notched below into sections, and drawn into points above. *Cataphyll* transparent, membranous. *Leaves* 2–5, basal, ensiform to lanceolate, acute, usually prostrate, blade flat, the stem also bearing leafy bracts. *Stem* usually prostrate at the base, erect above, occasionally branched, with a few to several leafy bracts, bearing a small cormlet in the axil of each leaf and bract. *Spike* 2–8-flowered, or flowers all aborted but floral bracts subtending cormlets; *bracts* green, 3–6(–10) mm long, the inner about as long or longer than the outer in those subtending flowers, much smaller where flowers

aborted, a cormlet produced in the axil of each sterile bract and, after flowering, in the axils of the floral bracts. *Flowers* stellate, white (or not produced on some plants); *perianth tube* infundibuliform, 3–4 cm long, reaching apex, or slightly exserted from bracts; *tepals* 7–10 mm long, spreading, ovate, 2–3 mm wide. *Filaments* 3–4 mm long; *anthers* 2–3 mm long. *Ovary* 3–4 mm long, *style* dividing near the apex of the anthers, branches ca. 1.5 mm long, recurved. *Capsules* and seeds never developed. *Chromosome number*, $2n = 39$ (Goldblatt 458, 515, 6444, Goldblatt s.n. no voucher, High Noon Mts.; Esterhuysen 35281A).

Flowering time. October to December (to January).

Distribution. Mountains along the western Cape coast and interior from the Cape Peninsula to the Cedarberg, shady south-facing slopes, rock cracks, often in damp sites with moss. Figure 30.

Geissorhiza bolusii is a poorly collected, yet widespread species, common in suitable habitats in the mountains of the western Cape. It favors cool damp sites in shallow soil under rocks or in cracks of south-facing cliffs or along watercourses, and it is often associated with moss. The species is unusual, being triploid, $2n = 39$ (counts from five separate populations from different parts of its range), and it never reproduces by seed. Instead a small cormlet develops in the axil of each leaf and stem bract. Some flowering stems produce no flowers, but a cormlet in the axil of each flower bract. Other stems produce small white flowers, but no capsules, and a cormlet later develops in place of each aborted ovary. The presence of these two kinds of stems, flowering and vegetative, is one characteristic feature of *G. bolusii*, and most collections comprise plants of both kinds, including the type collections of *G. bolusii* and *G. rupestris*, the latter reduced to synonymy here. One of the three type collections of *G. dregei*, Drège s.n. from Paarl Mountain, chosen here as lectotype for this species, also exhibits this characteristic. The two other type collections consist of rather poor specimens of *G. parva*. Thus *G. dregei*, recognized as distinct by Foster (1941), is likewise reduced to synonymy in *G. bolusii*.

Geissorhiza bolusii is probably most closely related to *G. ovalifolia* which grows in similar habitats and also has small, white flowers. *Geissorhiza ovalifolia* usually has none or only one cauline leaf or bract, and produces one or few

cormlets in its leaf axils. In *G. ovalifolia*, fruit development is evidently fairly rapid and immature capsules can be seen in some collections in which fading blooms are present at the ends of spikes.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Piketberg (D-), Barker 7856 (NBG); Gryskop, Piketberg, 3,500 ft. (DC), Pillans 7400 (BOL); Zebrakop, Piketberg, 3,000–4,000 ft., Esterhuysen 35805 (MO).

3219 (Wuppertal) N Cedarberg at Koupoort (AA), Esterhuysen 12188 (BOL); Cedarberg, Middelberg vlakte, under boulders (AC), Goldblatt 5135 (K, MO, PRE, S); Elandskloof, rock ledges (CA), Bond 677 (NBG); Hexberg, Cold Bokkeveld Mts., Goldblatt 7114 (K, MO); Warm Baths, Olifants River Valley, Edwards s.n. (BOL 14430); Bo-Boskloof, Cold Bokkeveld (CC-CD), Rourke 651 (NBG).

3318 (Cape Town) Table Mt., S aspect (CD), H. Bolus 4617 (BOL); Table Mt., Ecklon 311 (G, K, M, PRE, S), Marloth 8041 (PRE); Platteklip Gorge, Dummer 858 (E); Devils Peak, Wolley Dod 488 (BOL); Cecilia, Barker 20181 (NBG); Lions Head, damp places near chains, Rennie s.n. (CT); Paarl Mt. (DB), Drège s.n. (G, K, MO); Jonkershoek, below first Ridge Peak, 2,900 ft. (DD), Kerfoot 6097 (NBG); Simonsberg, kloof near Helshoogte, Esterhuysen 35281A (MO).

3319 (Worcester) Groot Winterhoek, moist rocks (AA), Marloth 2329 (PRE); Witsenberg (AC), Zeyher 3958 (SAM); shady damp rocks, upper Tulbagh Waterfall, Burgers 2586 (STE); Milner Peak, Hex River Mts. (AD), Esterhuysen 14240 (BOL); Hex River valley (BC), Davidson 116 (SAM), 53 (SAM); Bains Kloof (CA), Schlechter 9167 (B, BM, BOL, E, G, H, K, L, MO, PH, PRE, Z), Esterhuysen 32723 (BOL), Goldblatt 458 (BOL), Kies 380 (PRE), L. Bolus s.n. (BOL), Barker 4250 (NBG, W); Cossacks, Slanghoek Mts., ca. 4,000 ft., Esterhuysen 35823 (C, K, WAG); Sneeuwkop Mts., Wellington, Thorne s.n. (SAM 46558); Du Toits Kloof, Loubser 861 (NBG), H. Bolus 5247 (BOL, K); Slanghoek Mts., Esterhuysen 9454 (BOL); Waaihoek Peak, damp bank (CB), Esterhuysen 18190 (BOL); French Hoek Pass (CC), Barker 4910 (BOL); Jonaskop, Riviersonderend Mts., under rock overhang (DC), Goldblatt 6444 (MO, PRE).

3418 (Simonstown) slopes of Constantiaberg (AB), Lewis 1569 (SAM); Constantiaberg, Compton 14171 (NBG), Wolley Dod 1933 (K); near Constantia corner, Lewis 1488 (NBG).

17. *Geissorhiza parva* Baker, Kew Bull. 1906: 26. 1906; Foster, Contr. Gray Herb. 135: 60. 1941. TYPE: South Africa. Cape: Houw Hoek, Penther 723 (holotype, K). FIGURE 31.

Ixia excisa L. f., Suppl. Pl. 92. 1782; Thunb., Diss. de *Ixia* no. 24. 1783, pro parte excl. Thunberg s.n. "*Ixia excisa* α" [lectotype of *I. excisa* L. f. (Goldblatt, 1983) = *G. ovata* (Burm. f.) Asch. & Graeb.]; Thunberg s.n. "*Ixia excisa* β" (syntype, UPS = *G. parva*).

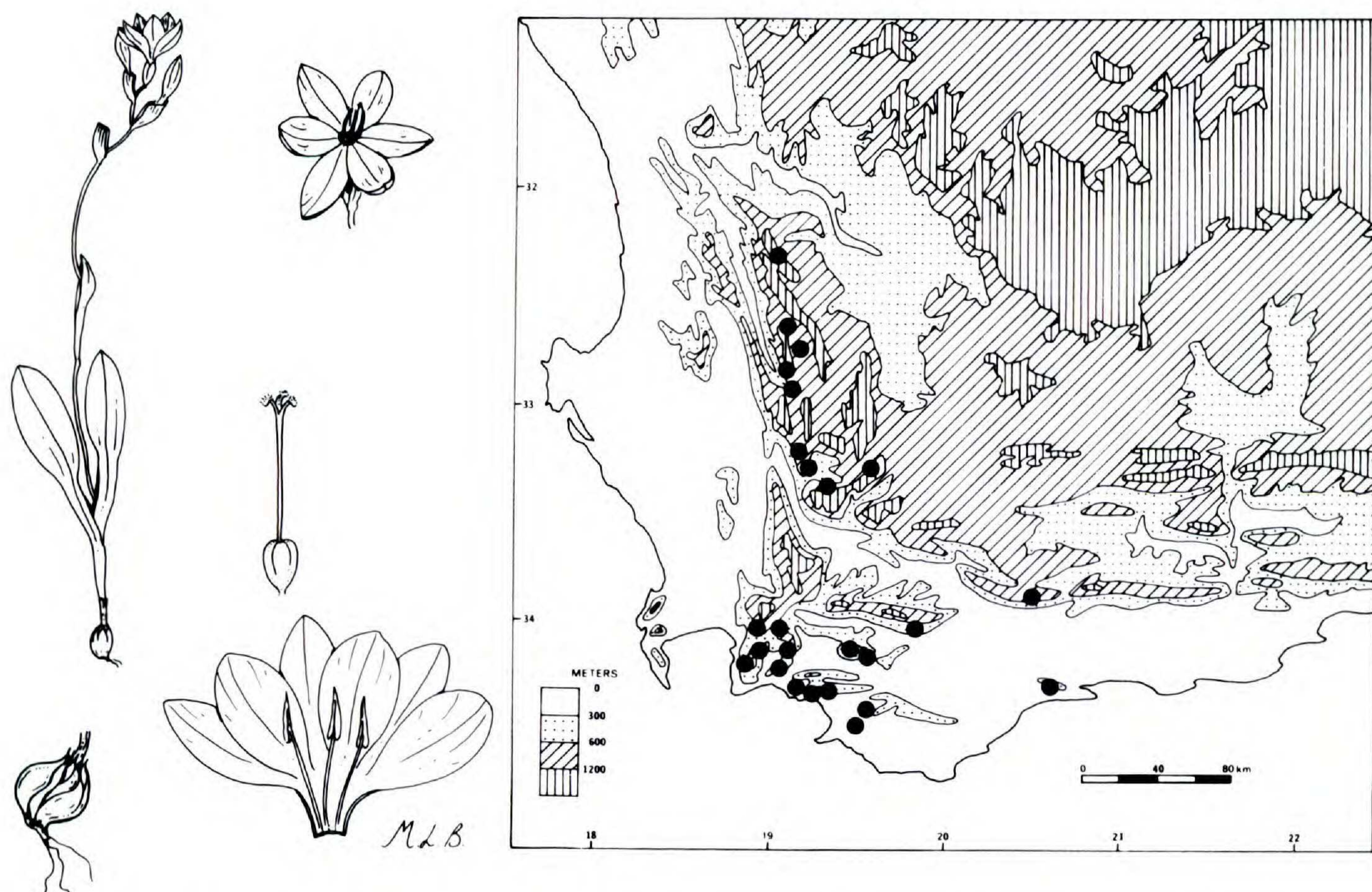


FIGURE 31. Morphology and distribution of *Geissorhiza parva*. Habit $\times 0.5$; corm, flower, and gynoecium life size; opened flower $\times 2$ (Goldblatt 5897, Caledon Zwartberg).

Geissorhiza dregei Baker, Handb. Irid. 158. 1892, Fl. Cap. 6: 74. 1896, pro parte excl. Drège s.n. "*G. secunda* β Ker α " (lectotype of *G. dregei* = *G. bolusii* Baker).

Geissorhiza tabularis Ecklon ms. [Ecklon & Zeyher Irid. 222 (90.9)].

Plants small, 4–7(–12) cm high. *Corm* ovoid-conic, 3–5 mm diam., asymmetric, obliquely flattened towards base, the flat part extending downwards shortly, tunics dark brown, concentric, the layers firm textured, fragmenting irregularly. *Cataphyll* membranous brown, usually persistent and accumulating around the base. *Leaves* 3–4, all basal or the uppermost cauline, 1.5–2(–4.5) cm long, prostrate or inclined, much shorter than the stem, ensiform to oblong, rarely linear, occasionally ovate, usually minutely red-dotted or streaked, acute or obtuse, margins occasionally ciliate to papillose towards the apex. *Stem* smooth, erect above, often prostrate for a short distance at the base, simple or rarely branched, flexed above the cauline leaf. *Spike* (1–)2–6-flowered; *bracts* herbaceous, usually red on the margins, 4–6(–8) mm long, the inner slightly shorter than the outer. *Flower* stellate, creamy white to pale yellow; *perianth tube* 3–4

mm long, included or just exerted from the bracts, gradually widening from the base; *tepals* extended horizontally, more or less ovate, 6–8 mm long, 2.5–3.5 mm wide. *Filaments* ca. 2 mm long, erect; *anthers* 2–2.5 mm long, pollen yellow. *Ovary* ca. 2 mm long, *style* dividing at the apex of the anthers, branches 1.5–2 mm long, recurved. *Capsule* globose to oblong, 3–7 mm long. *Chromosome number*, unknown.

Flowering time. Mid-August to October (to early December at high altitudes).

Distribution. Sandy and often very thin mountain soils in the southwestern Cape, extending from the Cedarberg south to the Langeberg near Swellendam; mainly montane at middle to upper elevations but occasionally at low altitudes near the coast in the Caledon district. Figure 31.

Geissorhiza parva is clearly closely allied to *G. ovata*, a species similar in habit with short prostrate or semi-prostrate leaves and a long perianth tube, but larger in all features and having particularly long-tubed white flowers, marked red at the base of the tepals and on the reverse of the tepals and tube. The difference in size, flower

color, and length of the perianth tube in the two species makes confusion unlikely. *Geissorhiza parva* sometimes grows in open soil, occasionally together with *G. ovata*, but more often on thin soil on wet rocky pavement or on rocks in damp moss. It has a wide range, extending from the Cedarberg southwards to the Caledon district and east to the Langeberg near Swellendam. Populations occurring north of the Hex River Mountains can usually be distinguished by having four leaves, in contrast to the southern populations which normally have only three. The difference is not without exception, e.g., *Stokoe s.n.* from the Riviersonderend Mountains in the south, and *Esterhuysen 35719* from the Hex River Mountains to the north, consist of plants with either three or four leaves.

Some northern populations of *Geissorhiza parva* can be difficult to distinguish from the related *G. ovalifolia*. This species has white flowers, soft-textured leaves, and usually an axillary cormlet near ground level. The two species can usually be separated by a combination of these characters.

Specimens from the Commonage below the Zwartberg at Caledon, *Guthrie s.n.*, are probably hybrid with *Geissorhiza ovata*. Some individuals of this collection have very large flowers with the reverse of the outer tepals flushed red. The flowers have tepals to 13 mm long and a tube as long as 6 mm, a size intermediate between *G. parva* and *G. ovata*.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cedarberg, Middelberg (AC), *Goldblatt 5137* (MO, NBG); Elands Kloof (CA), *Lewis s.n.* (BOL 31893), *Barker 3087* (NBG); Cold Bokkeveld, 33.5 km E of Citrusdal, *Goldblatt 4203* (K, MO); Olifants River Valley, Grootfontein above the Toorgat (CC), *Oliver 3973* (K, PRE, STE); Hexberg, Cold Bokkeveld Mts., 4,000 ft., *Goldblatt 7115* (MO, PRE); Cold Bokkeveld, Wabooms River-Ysterfontein (CD), *Lewis 2644* (SAM); E side of Bokkeveld Sneeuksop, after fire, in wet sand, *Esterhuysen 36126* (BOL, K, MO, PRE, S, US, WAG).

3319 (Worcester) Visgat (AA), *Stokoe s.n.* (SAM 63130); Michells Pass (AD), *Esterhuysen 6145* (BOL); near reservoir, Ceres, *Guthrie s.n.* (BOL 17233); Skurfdeberg, shallow damp soil over flat rock, *Esterhuysen 21869A* (BOL); sandy flats, foot of Skurweberg, Agterwitsenberg vlakte, *Goldblatt 4426* (MO); Matroosberg, 5,000 ft., shallow muddy soil (BC), *Esterhuysen 35719* (BOL, K, MO, PRE, S).

3320 (Montagu) near base of Crown Mt., Swellendam (CD), *Wurts 282* (NBG).

3418 (Simonstown) Hottentots Holland, Moorde-naarskop (BB), *Esterhuysen 9131* (BOL); Rockview Dam site, Kogelberg, *Snijman 550* (NBG); Kogelberg Forest Reserve (BD), *Boucher 1942* (PRE, STE); Platteberg, *Stokoe s.n.* (SAM 61723).

3419 (Caledon) flats E of Viljoens Pass (AA), *Davis s.n.* (SAM 61726), *Stokoe s.n.* (SAM 61724); Viljoens Pass, *Stokoe s.n.* (SAM 49600); Lebanon State Forest, Jakkalsrivier Catchment II, moist path in peaty soil, *Haynes 1243* (STE); Houw Hoek Pass, near Bot River, *van Niekerk 785* (BOL); Caledon Zwartberg (AB), *Goldblatt 5897* (K, MO, NBG); Zwartberg near Caledon, *Galpin 4675* (K, PRE); Caledon, commonage below Zwartberg, *Guthrie 16916* (BOL); Highlands Forest Reserve, wet flats (AC), *Goldblatt 4779A* (MO); Hawston, sand hills near lagoon, *Walgate 1087* (BOL); Vogelgat, cleared path at 1,500 ft. (AD), *Goldblatt 5348* (MO); Vogelgat, roads end, 410 m, *Williams 2859* (NBG); 8 mi. from Stanford on road to Elim, *Gillett 4499* (BOL, BR, MO); Riviersonderend Mts. (BA-BB), *Stokoe s.n.* (SAM 63482); Swellendam, "am Ufer des Riviersondereinde bei Appelskraal" (BB), *Ecklon & Zeyher Irid. 222* (90.9) (B, FI, G, LD, MO); Olifantshoek, *Ecklon & Zeyher Irid. 221* (K, SAM); 2 mi. N of Papiessvlei (BC), *Acocks 22868* (K, PRE); Salmons-dam Nature Reserve, *Goldblatt 437* (BOL); Sandys Glen (BD), *Goldblatt 4849* (K, MO, NBG); flats near Baard-scheerdersbos (DA), *Lewis 6007* (NBG).

3420 (Bredasdorp) Potteberg, De Hoop (BC), *Burgers 2247* (PRE, STE).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, *Herb. Burman s.n.* (G).

18. *Geissorhiza ovata* (Burm. f.) Asch. & Graeb., Syn. Mitteleur. Fl. 3: 540. 1906; Foster, Contr. Gray Herb. 135: 59. 1941; Lewis, Fl. Cape Penins. 254. 1950. *Ixia ovata* Burm. f., Fl. Cap. Prod. 1. 1768. TYPE: South Africa. Cape: precise locality not known, *Burman s.n.* (holotype, Herb. Burman G). FIGURE 32.

Ixia excisa L. f., Suppl. Pl. 92. 1782, Thunb., Diss. de *Ixia* no. 24: 151. 1783. *Geissorhiza excisa* (L. f.) Ker, Ann. Bot. (König & Sims) 1: 224. 1804; Baker, Handb. Irid. 159. 1892, Fl. Cap. 6: 76. 1896. TYPE: South Africa. Cape: exact locality unknown, *Thunberg s.n.* "*Ixia excisa* α" [lectotype, Herb. Thunb. 951 UPS, effectively designated by Brown (1928); isolectotypes, S "Herb. Montin," "Herb. Castrom," "Herb. Swartz"]; "*Ixia excisa* β" (syn-type, Herb. Thunb. 952 UPS).

Weihea excisa (Burm. f.) Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 22. 1827, comb. illeg. gen. non. val. descr.

Plants 6–15 cm high. *Corm* asymmetric, ovoid, obliquely flattened below, the flat part extending shortly downwards, tunics light to dark brown, concentric, drawn into points above. *Cataphyll* dry, brown, papyraceous. *Leaves* 2–3, the upper often bract-like and inserted on upper part of the stem, the lower two basal, prostrate or inclined, much shorter than stem (1–)1.5–3(–6) cm long, 5–12(–14) mm wide, ovate-oblong, acute or obtuse, the margins usually ciliate, sometimes the blade also ciliate-pubescent on the veins (rarely

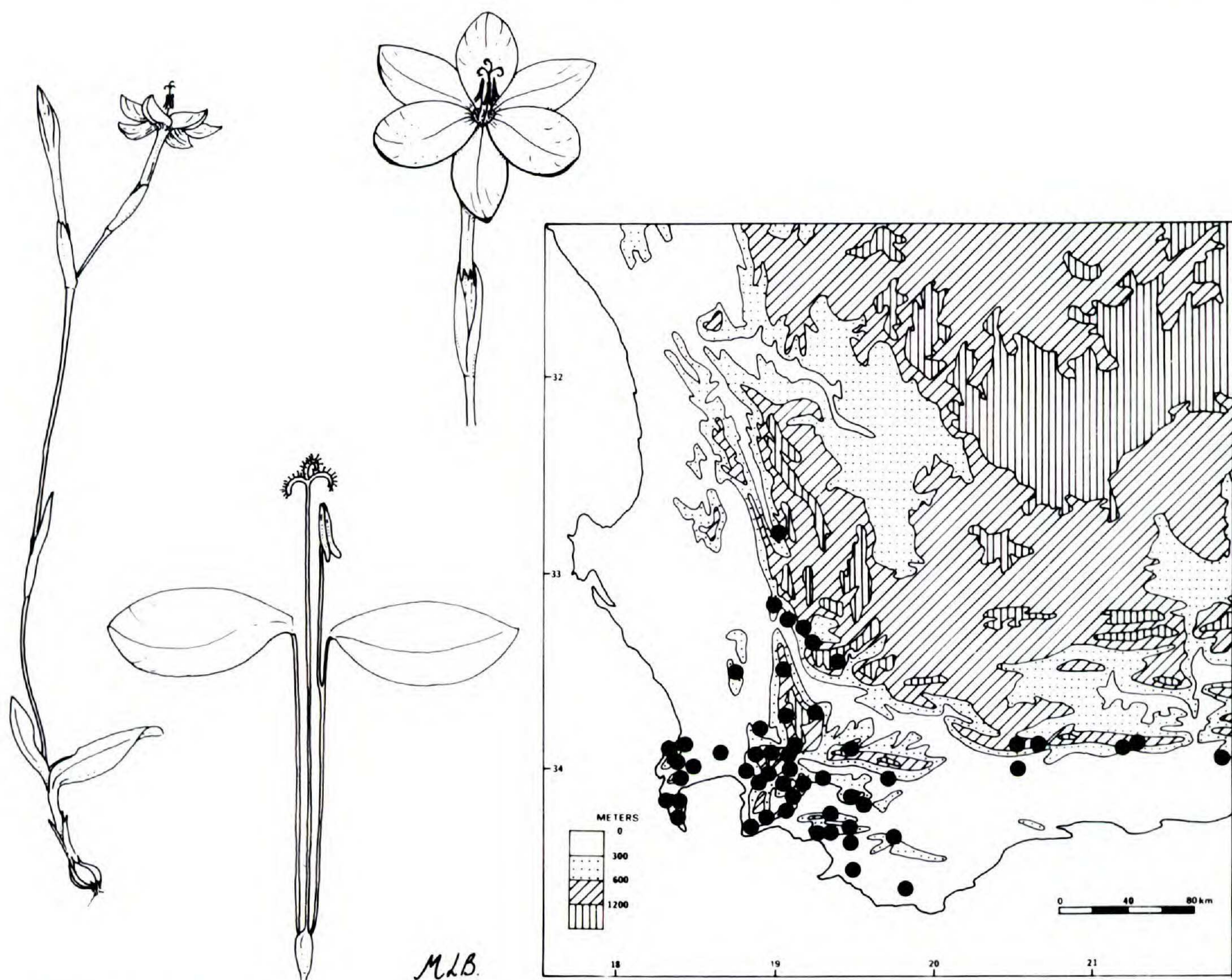


FIGURE 32. Morphology and distribution of *Geissorhiza ovata*. Habit $\times 0.5$; flower life size; section of flower $\times 1.5$ (Goldblatt 5879, Jonaskop).

pubescent throughout—*Thomas s.n.*—NBG 60659), frequently minutely brown-pellucid dotted throughout, or only towards the edges, margins thickened, often reddish. *Stem* erect above, often prostrate for a short distance at the base, unbranched. *Spike* (1–)2–6-flowered; *bracts* herbaceous, often brown dotted, 7–10(–12) mm long, the inner slightly shorter than the outer. *Flower* hypocrateriform, white or pale pink above with red marks at the base of the tepals, dark red (to brownish) on the reverse, actinomorphic; *perianth tube* cylindric, 10–18(–30) mm long, well-exserted from the bracts; *tepals* extended horizontally, lanceolate-obovate, (7–)10–13 mm long, (3.5–)5–7 mm wide. *Filaments* exserted from the tube, sometimes to 5 mm, erect; *anthers* 2–4 mm long. *Ovary* 2–3 mm long, *style* dividing at or near the apex of the anthers, branches 1.5–2 mm long, recurved. *Capsule* 6–8 mm long, rotund. *Chromosome number*, $2n = 26$ (Goldblatt 217).

Flowering time. (Late July to) August to October.

Distribution. Sandy mountain soils in the southwestern Cape, extending from the Cape Peninsula north to the Olifants River Mountains and east to Garcias Pass in the Langeberg; mainly montane at middle to upper elevations but also at low altitudes near the coast; usually very common after fires. Figure 32.

Geissorhiza ovata is a fairly common southwestern Cape species, especially frequent in mountain habitats after a veld fire the previous summer. It is very distinctive, having a pair of ovate or oblong, obtuse leaves prostrate or nearly so, and an erect stem with unusually long-tubed and large, white flowers marked with red in the center and on the reverse of the tepals.

It is clearly allied to *Geissorhiza parva*, a dwarf species with small yellowish cream flowers which grows on thin soil on wet rocks or moss banks, or in open soil, sometimes together with *G. ovata*. The two species are similar in their habit, having short, prostrate or semi-prostrate leaves and flowers with a long well-developed perianth

tube, although the tube of *G. ovata* is considerably longer than that of *G. parva*.

The species is quite variable and as treated here comprises several unusual forms that should be mentioned. Collections from the Klein River Mountains, especially *Ecklon & Zeyher Irid.* 219 and *Stokoe s.n.* (SAM 55713, 59841), have an unusually long perianth tube, 20–30 mm long. In contrast, some collections from the Sir Lowrys Pass-Nuweberg area have a very short perianth tube only 7–10 mm long (*Compton* 9205, *Guthrie* 2530). Plants from near the eastern end of its range (*Muir* 5018—Slang River, Swellendam) have the smallest tepals, ca. 7 mm long, of any population of the species although the perianth tube is of normal length. A hairy leaved form has been recorded from Fairfield, Caledon (*Thomas s.n.*, NBG 60659). None of these variants seems worth taxonomic recognition as they do not differ sufficiently from the more common and typical form of *G. ovata* and are connected by specimens intermediate in these extreme characters to more typical forms.

Although *Ixia ovata* Burm. f. was the earliest name for *Geissorhiza ovata*, having been described in 1768, the later synonym *I. excisa* L. f. was more frequently used and when Ker (1804) transferred the species to *Geissorhiza*, he used the later synonym in the combination despite the fact that he knew and cited the earlier *I. ovata*. *Geissorhiza excisa* was the name used for the species throughout the nineteenth century, until Ascherson and Graebner made the combination *G. ovata* in 1906.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Grasruggens, Olifants River Mts. (CC), *Oliver* 3990 (STE).

3318 (Cape Town) Lions Head (CD), *Zeyher s.n.* (SAM 20882), *Pappe s.n.* (BM); Camps Bay, *Zeyher* 30 (SAM), *Cassidy* 285 (BOL, NBG); Zonnebloem, *Zeyher* 80 (B); Table Mt., *Ecklon* 831 (B, E, G, K, S, Z), *Rehmann* 593 (BM, BR, Z), *Prior s.n.* (Z), *Scott Elliott s.n.* (E), *Alexander s.n.* (K); Weather Station, Table Mt., *Werdermann & Oberdieck* 54 (B); Table Mt., above Klaassenbosch, *H. Bolus* 4704 (BM, BOL, GH, K, M, NBG); slopes of Devils Peak, *MacOwan s.n. in Herb. Norm. Austr. Afr.* 259 (B, BM, G, GH, K, SAM, Z); Table Mt., lower plateau, *Lewis* 4797 (NBG); Newlands, *Wilms* 3707 (B, BM, K); N slopes of Paardeberg (CA), *Goldblatt* 648 (BOL); Langverwacht, above Kuils Rivier (DC), *Oliver* 4369 (PRE, STE); Jonkershoek, Jakkalsvlei (DD), *Taylor* 5065 (PRE, STE); Swartboskloof, Jonkershoek Valley, *Lewis* 1660 (BOL, SAM); Simonsberg, moist shady rocks, *Compton* 14194 (NBG); Stellenbosch flats, *Garside* 280 (K); Stellenbosch, *Prior s.n.* (K).

3319 (Worcester), Summit, Roodezand Mts. (AA), *Andreae* 613 (STE); lower slopes of the Witsenberg

(AC), *Leighton* 1339 (BOL); Tulbagh, *Grant* 2471 (BOL, WAG); Michells Pass (AD), *Compton* 11946 (NBG); Bains Kloof, W slope (CA), *Lewis s.n.* (BOL); Bains Kloof, *Compton* 17494 (NBG), *Hafstrom & Lindeberg s.n.* (S); Baviaans Kloof, above Waterfall, *Leighton* 1356 (BOL, PRE); Brandwacht Mts. (CB), *Esterhuysen* 8200 (BOL); French Hoek Peak, 4,500 ft. (CC), *Compton* 19856 (NBG); vleis on Wemmershoek Mts., 4,000–5,000 ft., *Wasserfall* 512 (NBG); French Hoek, *Phillips* 1311 (SAM); French Hoek Pass, summit ridge of Mid-dagkransberg, *Boucher* 2391 (PRE, STE); farm Stettyn, 15 mi. S of Worcester (CD), *Leipoldt* 3584 (BOL); Jonas Kop, N slopes, 3,000–4,000 ft. (DC), *Goldblatt* 5897 (MO); Jonas Kop, S slopes, 5,200 ft., *Thompson* 136 (STE).

3320 (Montagu) Swellendam Mts. (CD), *Galpin* 4677 (PRE); forest path below 10 O'Clock Peak, *Wurts* 359 (NBG); Tradouw Pass (DC), *Martin* 398 (NBG), *Copejans* 1034 (BR).

3321 (Ladismith) Garcias Pass (CC), *H. Bolus s.n.* (BOL), *Phillips* 380 (SAM), *Galpin* 4676 (K, PRE); Gysmanshoek Pass, Riversdale, *Hugo* 2707 (STE).

3322 (Oudtshoorn) Ruytersbosch, bushy hillside (CC), *van Niekerk* 130 (BOL); Kammanassie Mts. (DB), *Viviers & Vlok s.n.* (MO).

3418 (Simonstown) Hout Bay Nek (AB), *Salter* 6813 (BOL); Orange Kloof, *Wolley Dod* 523 (BOL); E slope of Constantiaberg, *Schlechter* 1458 (B, BM, G, H, W, Z); Vlakkenberg, *Compton* 20184 (NBG), *Wolley Dod* 1697 (BM); Redhill, *Taylor* 1550 (SAM); Simon's Bay, *Wright s.n.* (GH, K, P); Cape Point Reserve, below Ou Kanon (AD), *Taylor* 7349 (STE); Patrysvlei, *Wolley Dod* 2989 (BOL); Sir Lowrys Pass (BB), *Stokoe s.n.* (SAM 49614), *Werdermann & Oberdieck* 181 (B, K, PRE); Helderberg, Somerset West, *Parker* 3920 (BOL, GH, K, NBG); near Somerset West, *Ecklon & Zeyher Irid.* 294 (83) (B, FI, G, MO, S); Hottentots Holland, *Zeyher* 391 (B), *Hutchinson* 473 (K, PRE); slope above road to Disa Kloof, Bettys Bay (BD), *Ebersohn* 270 (NBG); Groot Hangklip, *Boucher* 585 (PRE, STE); near Oudebos, Palmiet River valley, *Boucher* 1889 (STE).

3419 (Caledon) Top of Houw Hoek Pass (AA), *Goldblatt* 371 (BOL); 6 mi. N of Bot Rivier, *Goldblatt* 217 (BOL); Lebanon Forest Reserve, Catchment II, *Kruger* 584 (NBG); Vijoens Pass, *Stokoe s.n.* (SAM 49613), *Strey s.n.* (M); Caledon commonage (AB), *Guthrie s.n.* (BOL); hillside near Caledon, *Crocker s.n.* (J 19879); Drayton siding, E of Caledon, *Goldblatt* 341 (BOL); Zwartberg, Caledon, *Zeyher* 3959 (BOL); clay slopes W of Eseljag Pass near Witdraai, *Goldblatt* 4019 (MO); Highlands (AC), *Leighton* 282 (BOL), *Compton* 13478 (NBG); Hermanus, *Salter* 1184 (BM), *Oldridge s.n.* (BOL); prope Hermanuspietersfontein, *H. Bolus* 9845 (Z); Fern Kloof Nature Reserve, Hermanus, *Orchard* 197 (MO, STE), 565 (MO), *Goldblatt* 5177 (MO), *Woodvine* 75 (MO, STE); Shaws Mountain (AD), *Barker* 11 (BOL, K), Vogelklip, Hermanus, *Barker* 1795 (NBG), *Goldblatt* 7033 (MO); Hemel en Aarde, top of pass, *Gillett* 1055 (STE); Mt. slopes behind Mossel River, *Martin* 564 (NBG); Klein River Mts., *Stokoe s.n.* (SAM 55713, 59841); "Kleynriviersberg," *Ecklon & Zeyher Irid.* 219 (58.8) (BM); Kleinriviersberge, *Zeyher* 3959, 3959a (B, BM, G, K, P, SAM, W, Z); Stanford valley, *Engler s.n.* (B); 26 mi. W of Rivier-sonderend (BA), *Mauve* 4705 (PRE); Fairfield (BC), *Thomas s.n.* (NBG 60659); between Baardscheerdersbos and Pearly Beach (DA), *Mathews* 2 (NBG, STE);

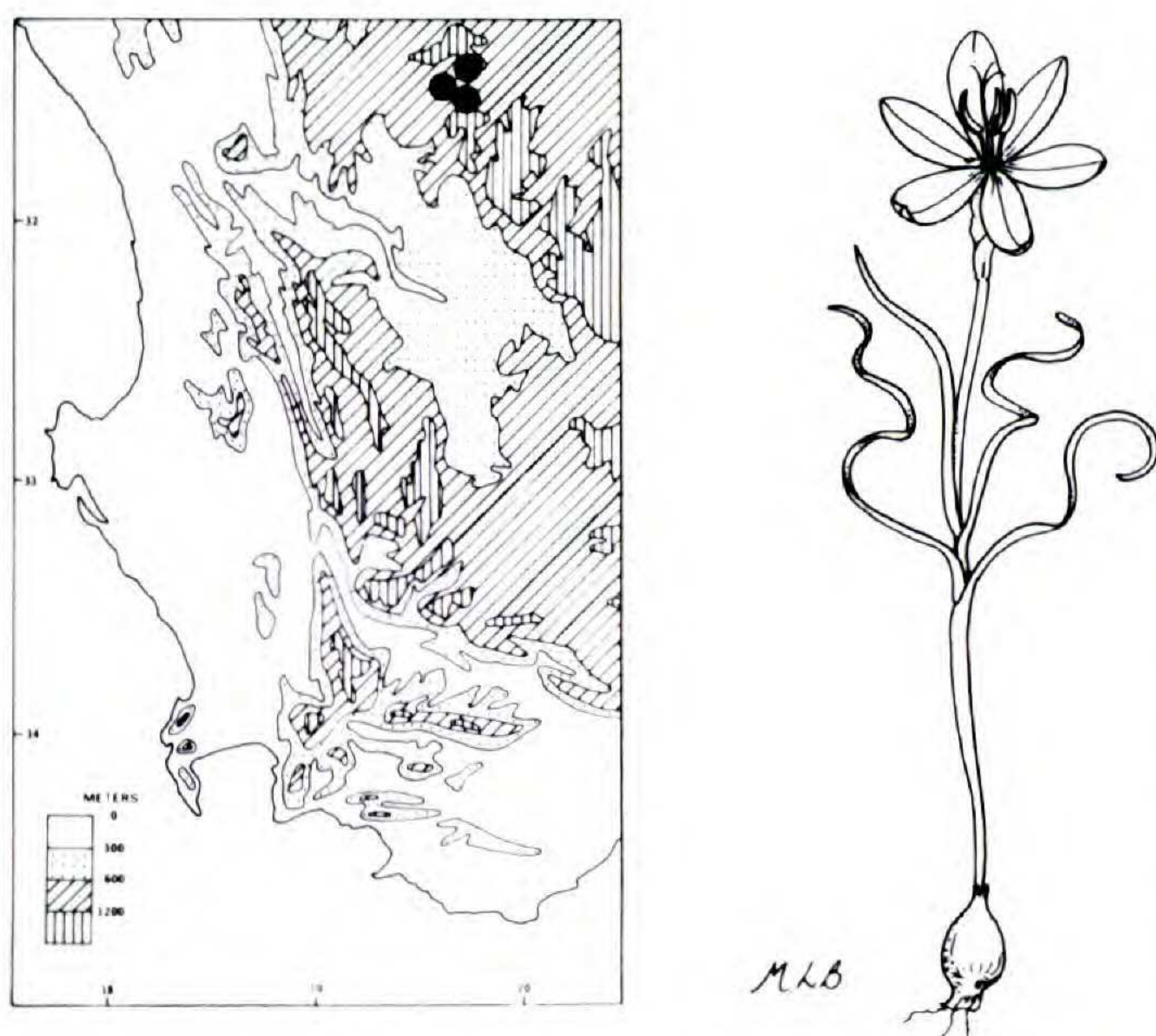


FIGURE 33. Morphology and distribution of *Geissorhiza corrugata*. Plant life size (Goldblatt 3985, flats S of Calvinia).

road to Ratel River, Bredasdorp, van Niekerk 304 (NBG).

3420 (Bredasdorp) road to Bontebok Park, 1 mi. S of main highway (AB), Goldblatt 3723 (MO, PRE, WAG); Bontebok Park, Liebenberg 6453 (PRE), Grobler 401 (STE); near Slang River, base of the Langeberg (BB), Muir 5018 (NBG).

WITHOUT PRECISE LOCALITY: Capstadt, Spielhaus s.n. (B); Cape, Bergius s.n. (B, G), Mund s.n. (B), Siebold 549 (B), Drège 1556 (B), Lichtenstein s.n. (B), Niven s.n. (BR), Thunberg s.n. (S "Herb. Castrom," "Herb. Montin," "Herb. Swartz," UPS), Pappe s.n. (S), Masson s.n. (BM), Roxburgh s.n. (BM, G), Alexander s.n. (1847) (K), Bowie s.n. (1817) (BM).

SECTION TORTUOSA

2. Section *Tortuosa* Foster, Contr. Gray Herb. 135: 69. 1941. TYPE: *G. corrugata* Klatt.

Leaves linear to subterete, all basal, straight or twisted, *stem* smooth, short, 1-flowered, *bracts* herbaceous, *flowers* actinomorphic or declinate (*G. karooica*), the *style* shorter than or reaching to the apex of the *anthers*.

19. *Geissorhiza corrugata* Klatt, Abh. Naturf. Ges. Halle 12: 391 (Erg. 57). 1882. TYPE: South Africa. Cape: Hantam-Gebirge, Meyer 24 (holotype, B). FIGURES 2, 33.

Plants small, to 5 cm high including flowers. *Corm* asymmetric, ovoid with an oblique flat side extending downward as a prominent ridge, 5–7 mm diam., tunics brown, concentric. *Cataphyll* single, membranous. *Leaves* 3–4, all basal, reaching the flowers, 1–2 mm wide, spirally

twisted, margins lightly thickened, the uppermost sheathing the stem below and more or less straight. *Stem* erect, single or 2–3 produced from the base. *Spike* 1(–2)-flowered; *bracts* 12–15 mm long, membranous, spreading above, pale, or flushed red above, the inner slightly shorter than the outer. *Flowers* yellow, campanulate; *perianth tube* to 3 mm long, infundibuliform; *tepals* 12–15 mm long, ovate, outer 5–6 mm wide, inner 4–5 mm wide. *Filaments* 4–5 mm long; *anthers* 5 mm long, yellow. *Ovary* 2–4 mm long, *style* 6–7 mm, dividing near the base of the anthers, branches to 6 mm long, spreading to laxly recurved. *Capsule* globose to ovoid, 8–10 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 3895).

Flowering time. August to September.

Distribution. Shale flats in the Calvinia district of the western Karoo. Figure 33.

Geissorhiza corrugata is a distinctive species, unusual in its spirally coiled leaves, solitary flowered inflorescences and style which branches towards the base instead of the apex of the anthers as is typical of most species of *Geissorhiza*. It shares these characters with the closely related, purple-flowered *G. spiralis*, from which it differs in having bright yellow flowers and a shorter perianth tube. Both species occur in the western Karoo (Figs. 33, 34), *G. corrugata* in the north, in the Calvinia district, and *G. spiralis* to the south in the southern Roggeveld around Sutherland.

The style of *Geissorhiza corrugata* and *G. spiralis* is intermediate between that found in *Geissorhiza* itself and in the related *Hesperantha*. In *Geissorhiza*, the style usually divides above the anthers, and the branches are typically short and recurved, while in *Hesperantha* the style divides at the top of a cylindric perianth tube (rarely within the tube) and the branches are long and spreading. Despite this intermediate type of style, the two species in question do not seem in any way connected with *Hesperantha*. *Geissorhiza corrugata* is self-compatible and autogamous, at least in the greenhouse, and its short style may be an adaptation to self-fertilization, the style branches being in contact with pollen during flowering. Reproductive biology is not known for *G. spiralis* but it may well be similar.

Specimens examined. SOUTH AFRICA. CAPE: 3119 (Calvinia) Hantam-Gebirge (BD), Meyer 24 (B); marshy ground near Calvinia, Schmidt 323 (PRE); 19 km S of Calvinia on Ceres Road, shale flats (DA), Goldblatt 3985 (E, K, MO, NBG, PRE, S, US, WAG), 6257 (BR,

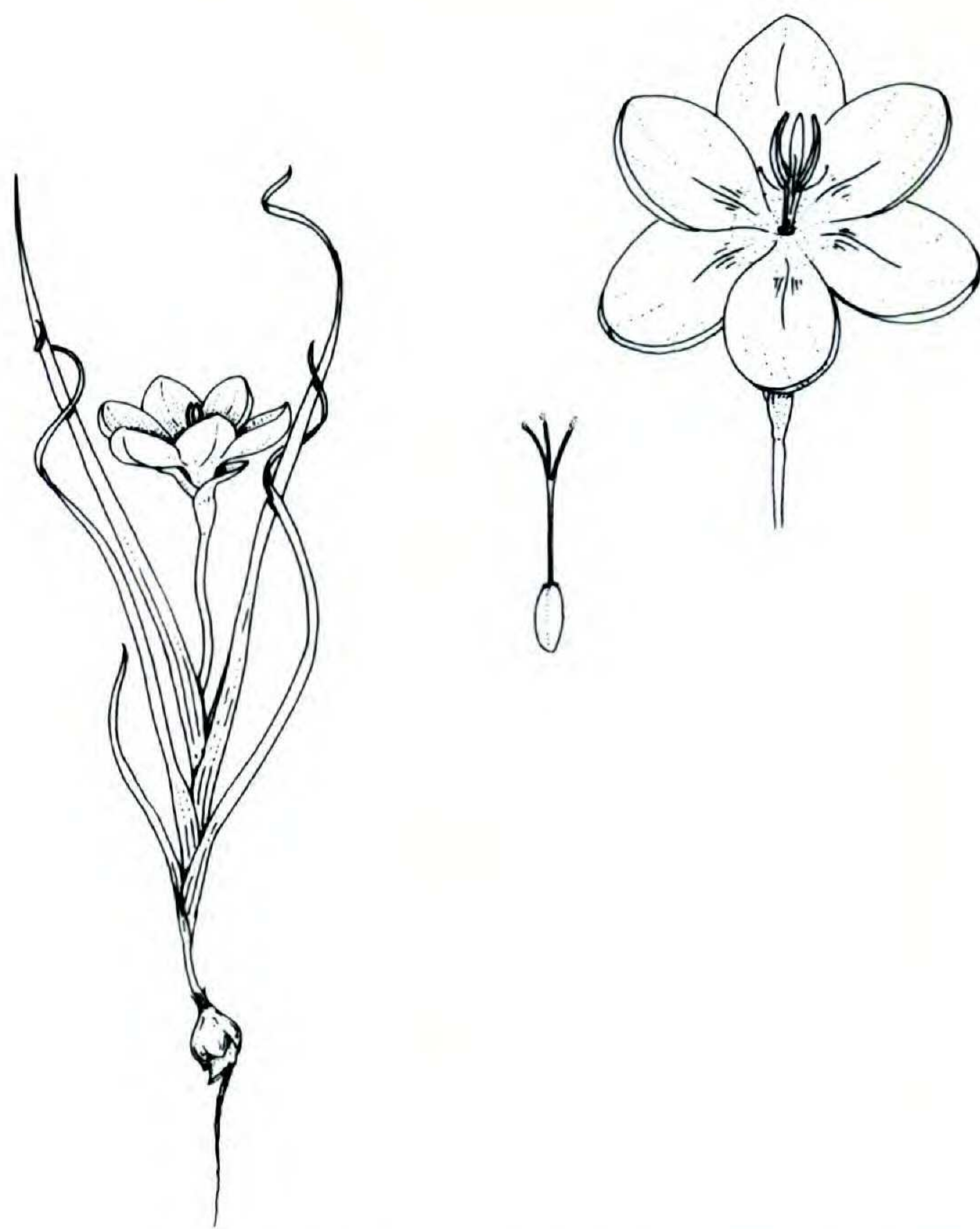
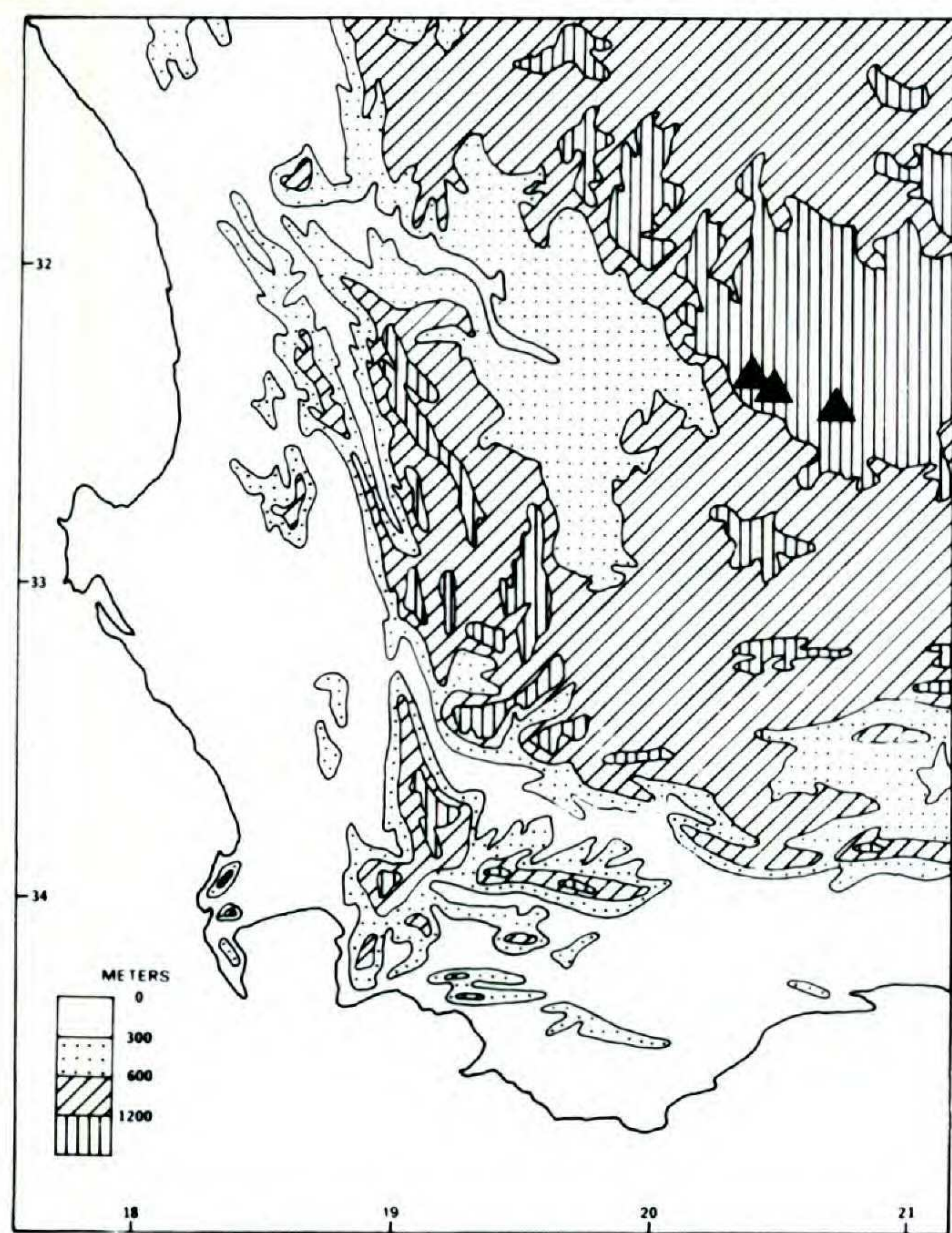


FIGURE 34. Morphology and distribution of *Geissorhiza spiralis*. Habit $\times 0.5$; flower and gynoecium life size (Lavranos 20617, NE of Sutherland).

C, MO, NU); Karigabosch Fontein, flats S of Calvinia, Thompson 2455 (STE); 5 mi. SSE of Calvinia (DB), Acocks 18940 (PRE, STE).

DOUBTFUL LOCALITY: Truders Pass, Namaqualand, Stayner s.n. (NBG 87605).

20. *Geissorhiza spiralis* (Burchell) De Vos ex Goldbl., comb. nov. *Trichonema spiralis* Burchell, Trav. S. Africa 1: 260. 1822. *Geissorhiza spiralis* (Burchell) De Vos, J. S. African Bot. Suppl. 9: 295. 1973, comb. inval. basion. et lit. ref. non cit. *Romulea spiralis* (Burchell) Baker, J. Linn. Soc., Bot. 16: 90. 1878. TYPE: South Africa. Cape: Roggeveld, Jakhalsfontein-Renosterrivier, Burchell 1356 (holotype, K). FIGURE 34.

Plants 2.5–4.5 cm high, including the flowers. *Corm* asymmetric, ovoid with an oblique flat side below, extending downward shortly, 4–7 mm diam., tunics brown, concentric. *Cataphyll* solitary, membranous. *Leaves* usually 4, basal, coiled or twisted distally, the uppermost sometimes straight and usually sheathing part or all of the stem, 0.5–2 mm wide, with the margins and midrib lightly thickened. *Stem* single, or 2–3 produced from the base, partly or entirely concealed by leaf bases. *Spikes* solitary flowered; *bracts* 10–

13 mm long, membranous, purple-flushed, the inner bracts slightly shorter than the outer. *Flower* broadly campanulate, purple, with darker marks towards the base of the tepals, the tepal bases and tube pale yellow; *perianth tube* 4–5 mm long, infundibuliform; *tepals* 13–15 mm long, broadly ovate, outer to 10 mm wide, inner to 8 mm wide. *Filaments* 4 mm long; *anthers* 5–6 mm long. *Ovary* ca. 3 mm long but enlarging rapidly after fertilization, *style* 6–7 mm long, dividing near the base of the anthers; *branches* 5 mm long, laxly spreading, not recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September.

Distribution. Known only from the southern Roggeveld near and to the east of Sutherland. Figure 34.

Geissorhiza spiralis was discovered in the early nineteenth century by William Burchell, the famous traveller-explorer of southern Africa. Burchell (1822) described it in his "Travels in the Interior of Southern Africa," assigning it to the genus *Trichonema* (syn. *Romulea*). Its correct identity was only recently established by De Vos (1972) during her studies on *Romulea*. Her proposed combination in *Geissorhiza* is without ci-

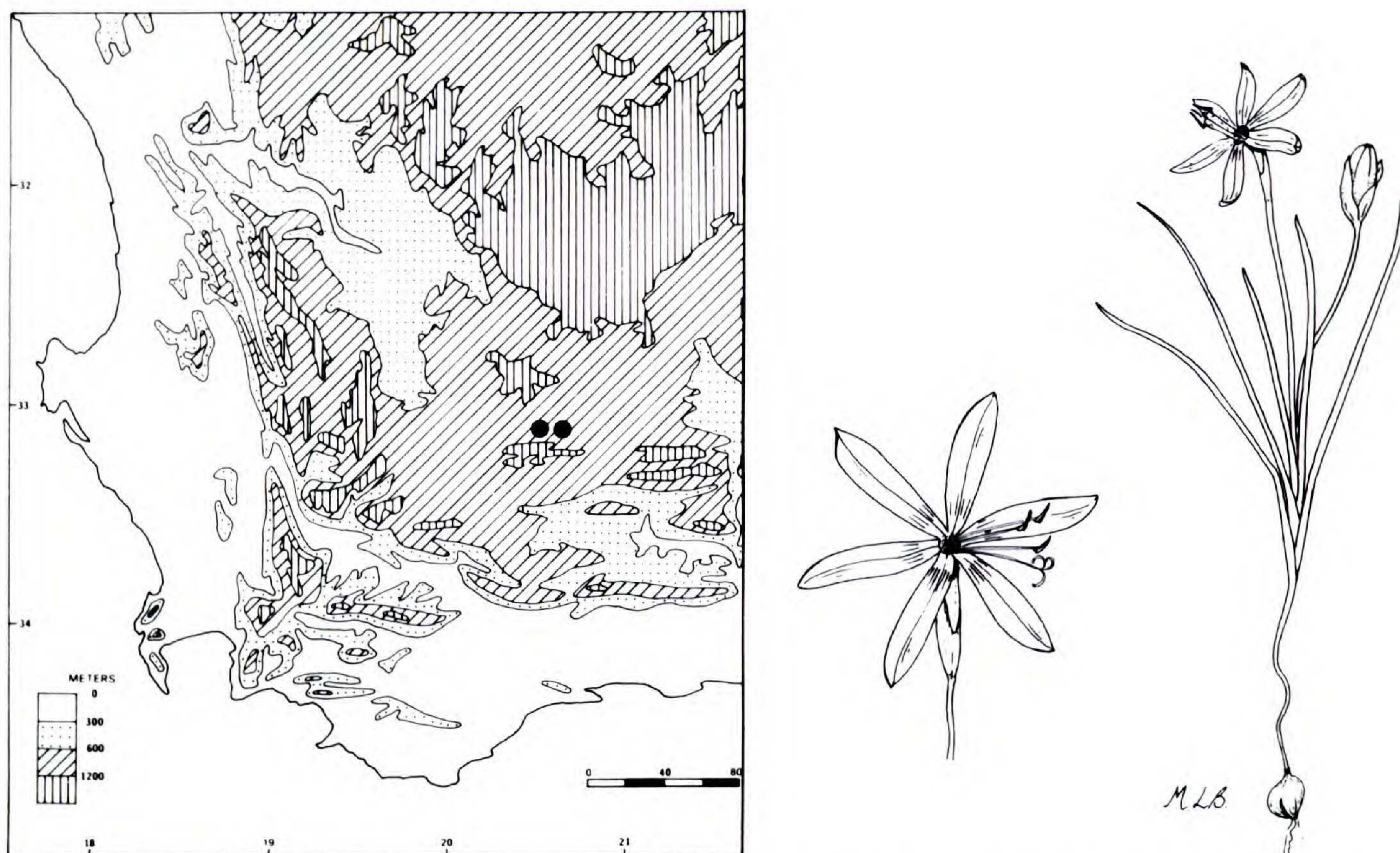


FIGURE 35. Morphology and distribution of *Geissorhiza karooica*. Habit $\times 0.5$; flower life size (Goldblatt 6371, Ghaap Kop, Matjesfontein).

tation of the basionym and place of original publication and thus invalid. The necessary citations are included here for legitimate combination.

The species is unusual in its several twisted leaves, solitary flowered spikes and style dividing at the base of the anthers. These features are also found in *Geissorhiza corrugata*, to which it is undoubtedly related. *Geissorhiza spiralis* can be distinguished from *Geissorhiza corrugata* by its purple flowers with a perianth tube 4–5 mm long as compared to the yellow flowers and short perianth tube, ca. 3 mm long of *G. corrugata*.

Specimens examined. SOUTH AFRICA. CAPE: 3220 (Sutherland) 30 km NE of Sutherland (BB), *Lavranos* 20617 (NBG); stony vlakte near Sutherland (BC), *Joubert & De Vos* 1584 (SAM, STE); SW of Sutherland, *De Vos* 2260 (STE); stony plain towards Waterkloof; *Marloth* 10404 (PRE, STE); Jakalsfontein-Renosterrivier (?BD), *Burchell* 1356 (K).

21. *Geissorhiza karooica* Goldbl., sp. nov. TYPE: South Africa. Cape: near Matjesfontein, foot of Ghaap Kop, *Goldblatt* 6371 (holotype, MO; isotypes, BOL, K, NBG, PRE, S, UC, US, WAG). FIGURES 3, 35.

Planta 3–6 cm alta, foliis 4–6 basalibus erectis vel

falcatis linearibus, spica florum unum, floribus hypocrateriformibus declinatis atrocaeruleis luteis in fauce, tubo (5–)6–8 mm longo, tepalis 12–15 mm longis, antheris 2.5–3.3 mm longis, stylo diviso prope basem antherarum, ramis recurvatis.

Plants 3–6 cm high. *Corm* globose, ca. 5 mm diam., tunics light brown, concentric, the outer layers breaking vertically into unequal sections. *Cataphyll* pale, dry, membranous. *Leaves* 4–6, linear, 1–1.8 mm wide, about as long as the stem, all basal, the upper 2–3 sheathing the stem below, erect, or becoming falcate, blade plane, margins not thickened. *Stems* 1–4, produced from the base. *Spike* solitary flowered; *bracts* 8–12 mm long, dry and membranous, brown above, reddish below, the inner about as long or slightly shorter than the outer. *Flowers* hypocrateriform, zygomorphic, dark violet purple, yellow at the base of the tepals and in the throat; *perianth tube* (5–)6–8 mm long, nearly cylindric, exerted from the bracts; *tepals* subequal, lanceolate, obtuse, 12–15 mm long, to 4–5 mm wide, extending at right angles to tube when fully open. *Filaments* 8–10 mm long, unilateral and declinate; *anthers* 2.5–3.3 mm long, pollen yellow. *Ovary* ca. 4 mm long, *style* dividing between the base and midline

of the anthers, branches 1.2–2 mm long, recurved. *Capsule* oblong to globose, 8–11 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 6371).

Flowering time. August to September.

Distribution. Margins of the western Karoo, north of the Witteberg, between Matjesfontein and Whitehill, on coarse shaley slopes. Figure 35.

This distinctive, dwarf species of *Geissorhiza* has so far been found in only two localities, in the arid southwestern Karoo north of the Witteberg Mountains in the Laingsburg district. It is unusual in having flowers solitary on the stems, of which up to four may be produced on each plant. The bright violet purple flowers are large and attractive and unusual in being zygomorphic. The stamens are unilateral and declinate while the tepals are subequal and regularly disposed. The four to six leaves are all inserted at the base, and are narrow and linear, but otherwise unremarkable.

Geissorhiza karooica appears to be allied to two peculiar species of the western Karoo, *G. spiralis* and *G. corrugata*, which have similar but actinomorphic flowers borne singly on each stalk, but have spirally coiled leaves and are also distinctive in having the style dividing near the anther base, a feature unusual in the genus. It seems likely that *G. karooica* is close to the line which gave rise to these two very reduced and unusual species of *Geissorhiza*, and the three species are united here in section *Tortuosa* of subgenus *Weihea*.

Specimens examined. SOUTH AFRICA. CAPE: 3320 (Montagu) Whitehill, Laingsburg (BA), *L. Bolus s.n.* (BOL 19156); base of Ngaap Kop, near Matjesfontein, *Esterhuysen 32639* (BOL, MO); shaley flats W of Ngaap Kop, *Oliver 3488* (STE); Ghaap Kop, abundant near base of shaley S-facing slope, *Goldblatt 6371* (BOL, K, MO, NBG, PRE, S, UC, US, WAG).

SECTION *PUSILLA*

3. Section *Pusilla* Goldbl., sect. nov. TYPE: *G. pusilla* (Andr.) Klatt.

Tunicae cormi lignosae, foliis planis infra et in marginibus pubescentibus, caule glabro, spica pauciflora, bracteis infra herbaceis supra siccis ferrugineis, floribus stellatis, tubo brevi.

Corm tunics woody, *leaves* ensiform, plane, pubescent on the margins and on the lower part of the blade, *stem* smooth, *spike* few flowered,

bracts herbaceous below, dry and ferrugineous in the upper half, *flowers* stellate, tube very short.

Species. 1.

22. *Geissorhiza pusilla* (Andr.) Klatt, Abh. Naturf. Ges. Halle (Erg. 58). 1882; Foster, Contr. Gray Herb. 135: 50–51. 1941. *Ixia pusilla* Andr., Bot. Repos. 4: tab. 245. 1802. *Geissorhiza secunda* var. *pusilla* (Andr.) Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 69. 1896. TYPE: South Africa. Cape: exact locality unknown (figure in Andr., Bot. Repos. 4: tab. 245. 1802). FIGURE 36.

Ixia secunda Ker excl. fig. et descr., Bot. Mag. 17: tab. 597. 1802, hom. illeg. non de la Roche (1768) et nom. illeg. superfl. pro *Ixia pusilla* Andr.

Geissorhiza secunda Ker, nonsensu Ker, Ann. Bot., (König & Sims) 1: 225. 1804, nom. illeg. superfl. (name applied to *G. aspera*).

Geissorhiza pubescens Wolley Dod, J. Bot. 38: 171. 1900. TYPE: South Africa. Cape: Signal Hill, *Wolley Dod 1602* [lectotype K, effectively designated by Foster (1941: 50); isolectotypes, B, BM, BOL]; Signal Hill, W slopes, *Wolley Dod 1246* (syntype, BOL).

Geissorhiza nigromontana Ecklon ms. (Zwarteberg bei Caledons Bad.)

Plants small to medium, 7–30 cm high. *Corm* 4–10 mm diam., globose, evidently asymmetric with a down-pointing projection on one side, tunics light brown, concentric. *Cataphyll* solitary, membranous, reaching ground level. *Leaves* 2–4, the lower, or all basal, the second or third leaf usually sheathing stem for about half its length, ensiform, erect to falcate, the longest not reaching the base of the spike, 3–8 mm wide, margins and sometimes lower part of the blade or sheath pubescent with long hairs, the margins also often ciliate, the uppermost leaf short, sometimes bract-like. *Stem* smooth, erect, simple or 1–2-branched. *Spike* (1–)2–6-flowered; *bracts* herbaceous below, brown and dry in the upper half and spreading, 5–8 mm long, the inner smaller than the outer. *Flower* stellate, pale to deep blue or blue-mauve; *perianth tube* 1–2 mm long, infundibuliform; *tepals* 7–10 mm long, to 4 mm wide. *Filaments* 2 mm long; *anthers* to 3 mm long, yellow. *Ovary* ca. 2 mm long, *style* 4–5 mm long, the branches ca. 1 mm long, recurved. *Capsule* obovoid to sub-globose, 5–7 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 196).

Flowering time. (Late August to) September to early October.

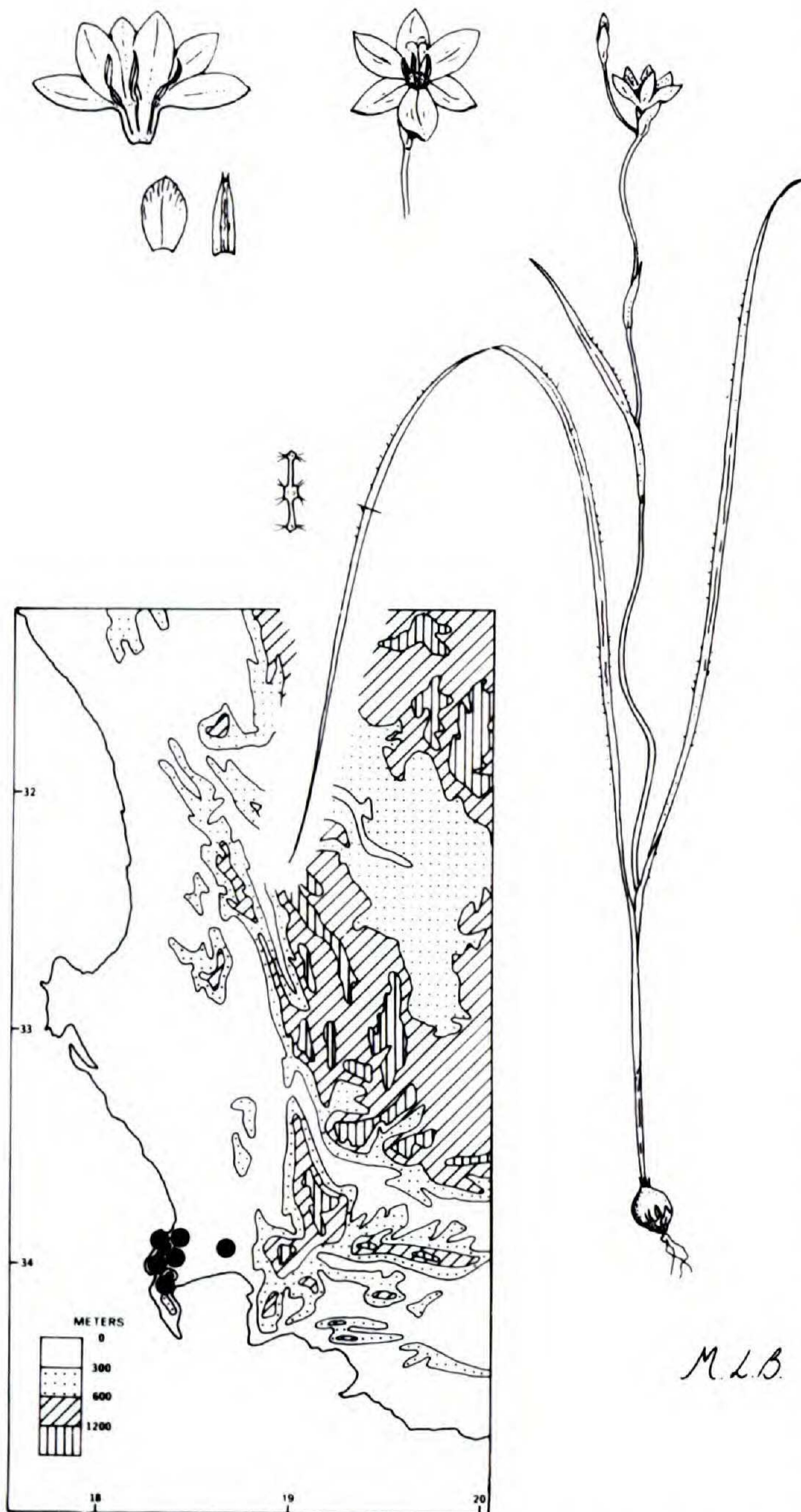


FIGURE 36. Morphology and distribution of *Geissorhiza pusilla*. Habit $\times 0.5$; flowers and separated bracts life size; leaf section much enlarged (Goldblatt 6643, Contour path, Kirstenbosch).

Distribution. Damp, often shady situations, mainly montane at low to middle elevations, Cape Peninsula and nearby hills. Figure 36.

As Wolley Dod correctly observed when describing *Geissorhiza pubescens*, a later synonym of *G. pusilla*, it closely resembles the very common *G. aspera* (syn. *G. secunda* sensu auct.) in general appearance, but is in fact quite distinct. It has light brown concentric corm tunics, typical of subgenus *Weihea*, and it must be assigned to this subgenus. The leaves are pubescent, the stem smooth, and the flower is rather smaller and paler

than is typical of *G. aspera*. *Geissorhiza pusilla* appears to have no close allies, and its relationships within subgenus *Weihea* are obscure. It may have an intersectional hybrid origin between species of section *Weihea* and either section *Ciliata* or *Planifolia* of subgenus *Geissorhiza*.

The type material of *Geissorhiza pusilla* is, as far as is known, the colored illustration in Andrews (Bot. Rep. 4: tab. 245. 1802). As Foster (1941) observes, the critical features of the species are not illustrated clearly. The corm tunics are merely shown as uniform light brown and there is no hint of the very characteristic leaf pubescence. Nevertheless, the aspect of the plant, its small, pale blue flower and corm color make it seem very likely that the interpretation placed on it by Klatt (1882) and Foster (1941) is correct.

Geissorhiza pusilla is relatively uncommon and it is found only in damper situations, mainly on heavier soils. It is restricted to the Cape Peninsula and the surrounding hills.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Cape Peninsula, slopes of Lions Head (CD), Lewis 1077 (SAM), Salter 7630 (SAM), Schlechter 1360 (B, Z), Barker 3866 (NBG), Ecklon s.n. (S); Signal Hill, Penfold s.n. (SAM 52895), Wolley Dod 1246 (BOL), 1602 (B, BM, BOL, K), Barker 407 (NBG), Goldblatt 196 (BOL); near Zonnebloem, slopes of Table Mt., MacOwan 2270 (K, SAM), Zeyher 81 (K, SAM); Devils Mt., opposite Woodstock, Scott Elliot 1078 (E); Devils Peak, above Groot Schuur, Wolley Dod 583 (BM, BOL); slopes of Devils Peak near Prince of Wales Blockhouse, Goldblatt 2719 (MO, PRE, US); foot of Devils Peak, Pappe s.n. (BM); contour path above Kirstenbosch between Skeleton and Window gorge, Goldblatt 4832 (MO); Kirstenbosch, Castle Butress above the contour path, Goldblatt 6643 (MO); Langverwacht, above Kuils Rivier (flowers opening mornings only) (DC), Oliver 4697 (K, MO, PRE).

3319 (Simonstown) Hout Bay (AB), Bond 1224 (NBG); Noordhoek, Dame Alice & the Misses Godman 313 (BM).

WITHOUT PRECISE LOCALITY: Cape of Good Hope (C.B.S.), Lalande s.n. (B); Capstatt, Spilhaus s.n. (B "Herb. Lubeck"), Verreaux s.n. (G), Mund s.n. (K).

DOUBTFUL LOCALITY: Caledon Zwartberg at the Baths, Ecklon s.n. (S); Hex River Valley, Dame Alice & the Misses Godman 487 (BM).

SECTION INCLUDANTHERA

4. Section *Includanthera* Goldbl., sect. nov. TYPE: *G. cedarmontana* Goldbl.

Tunicae cormi lignosae, foliis linearibus planis vel marginibus costisque incrassatis, spica pauciflora, floribus hypocrateriformibus, tubo longo e bracteis exsertis, staminibus styloque in tubo inclusis.

Corm tunics woody, *leaves* linear, plane or with the margins and midrib thickened, *spike* few flowered, *flowers* hypocrateriform, tube long, exerted from the bracts, the stamens and style very short and included in the lower half of the tube.

The two species of the section do not have the characteristic well-exserted style and stamens of *Geissorhiza*. The included stamens and style are clearly a secondary development and derived. In leaf, corm (not known for *G. esterhuyseniae*), and bract morphology, however, they accord well with *Geissorhiza* subgenus *Weihea*. Moreover, the style branches are short and thus consistent with the genus.

Species. 2.

23. *Geissorhiza esterhuyseniae* Goldbl., sp. nov.

TYPE: South Africa. Cape: Great Winterhoek, crevices in cliffs and rocky ledges, *Esterhuysen 28519A* (holotype, BOL).

Planta 7–18 cm alta, foliis (2–)3 lineari-falcatis, caule prostrato, floribus albis, hypocrateriformibus, tubo perianthii 10–16 mm longo, staminibus styloque inclusis, filamentis 3 mm longis, antheris 4.5 mm longis, stylo 0.5 mm longo, ramis ca. 2 mm longis, divergentibus.

Plants 7–18 cm high. *Corms* unknown. *Cataphyll* dry, membranous, brown below. *Leaves* (2–)3, plane, all basal or the uppermost inserted in lower part of stem, sometimes bract-like, linear or falcate, 3–5 mm wide, about half as long as the stem, obtuse, the margins lightly thickened. *Stem* apparently decumbent to trailing from steeply inclined surfaces, smooth, bearing a sheathing bract in upper part. *Spike* 1–3-flowered; *bracts* 12–14 mm long, green, becoming pale and membranous above, the inner bracts about as long, or shorter than the outer. *Flower* hypocrateriform, white, fragrant; *perianth tube* cylindric, 10–16 mm long, including the stamens and style, well-exserted from the bracts; *tepals* obovate 13–15 mm long, ? ca. 7 mm wide. *Filaments* ca. 3 mm long, inserted 2.5 mm from the base of the tube; *anthers* included in the perianth tube, 4.5 mm long, not reaching the middle part of the tube. *Ovary* 3–4 mm long, *style* short, 0.5 mm long, branches ca. 2 mm, diverging. *Capsule* and *seeds* unknown. *Chromosome number*, unknown.

Flowering time. October.

Distribution. Known only from a single col-

lection from high altitudes in the Great Winterhoek Mountains. Figure 37.

Geissorhiza esterhuyseniae is known only from a single gathering made by Elsie Esterhuysen, the well known Cape botanist, after whom the species is named. Her extensive collecting has made an extraordinary contribution to the knowledge of the Cape Flora, especially of mountain areas. This species is one of the most remarkable in the genus, having both stamens and style included within a long perianth tube. This set of characters is known in *Geissorhiza* elsewhere only in the northern Cedarberg species, *G. cedarmontana*, and these two species stand well apart in the genus. Differences and similarities between *G. esterhuyseniae* and *G. cedarmontana* are discussed fully under *G. cedarmontana*, the following species in this treatment. As the corms of *G. esterhuyseniae* are unknown, it is not possible to place the species to subgenus with certainty but in the absence of data to the contrary, *G. esterhuyseniae* is assumed to be related to *G. cedarmontana* and is assigned subgenus *Weihea* section *Includanthera*.

Both species grow at high altitudes in the mountains that run parallel to the western Cape coast, and in similar habitats, sheltered south-facing rocky situations. *Geissorhiza esterhuyseniae* occurs in the Great Winterhoek mountains at 2,000 m and *G. cedarmontana* in the northern Cedarberg, some 80 km to the north at altitudes above 1,200 m. It is likely that more localities for both will be found when the higher mountains separating the known ranges of the two species are more fully explored botanically.

It is interesting to point out that the unusual suite of floral characters found in *Geissorhiza esterhuyseniae* and *G. cedarmontana* also occur in two taxonomically isolated species of the related genus *Hesperantha*, *H. elsiae* and *H. cedarmontana*, as well as in *Ixia paniculata*, all of which also grow in the western part of the Cape Floristic Region. In the *Hesperantha* species, the style branches themselves are long as is typical for this genus, and the *Ixia* species has short style branches and corms with the reticulate tunics characteristic of *Ixia*.

Specimen examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Great Winterhoek, 6,000 ft., cliffs and rock ledges, south aspect (AA), *Esterhuysen 28519A* (BOL).

24. *Geissorhiza cedarmontana* Goldbl., sp. nov.

TYPE: South Africa. Cape: Cedarberg, Mid-

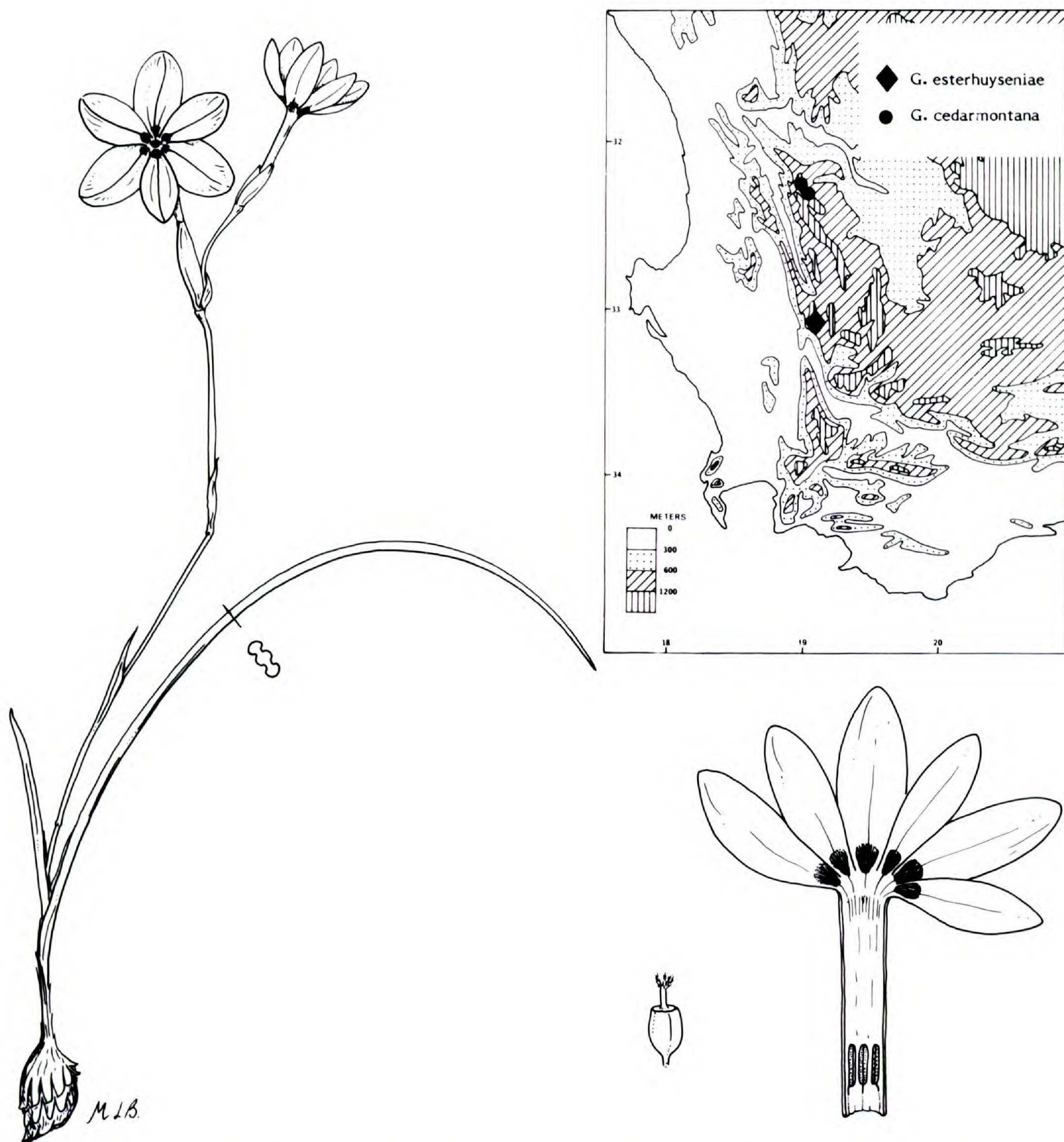


FIGURE 37. Morphology and distribution of *Geissorhiza cedar montana* and distribution of *G. esterhuyseniae*. Habit life size; opened flower and gynoecium $\times 2$; leaf section enlarged (Goldblatt 5145, Middelberg, Cedarberg).

delberg, *Goldblatt 5145* (holotype, MO; isotypes, K, NBG, PRE, S, WAG). FIGURES 4, 37.

Planta (7–)12–35 cm alta, cormo symmetrico, tunicis concentricis, foliis 2(–3), linearibus, caule erecto vel inclinato, spica (1–)2–5 florum, floribus hypocra-
teriformibus subroseis, maculis rubris ad basem tepalorum, tubo perianthii 13–15 mm longo, staminibus styloque inclusis, filamentis ca. 1 mm longis, antheris ca. 3 mm longis, stylo ca. 1 mm longo, ramis brevibus.

Plants (7–)12–35 cm high. *Corm* globose, symmetric, ca. 10 mm diam., tunics concentric, pale brown, notched below into segments and drawn into bristles above. *Cataphyll* membranous, brownish. *Leaves* 2–3, usually the lower two well-developed and basal, the upper of these sheathing the stem for some distance, linear, shorter or about as long as the stem, ca. 1.5 mm wide, margins and midrib heavily thickened, leaving 2 longitudinal grooves running along each leaf

surface, the uppermost leaf cauline, sometimes reduced and bract-like. *Stem* erect or inclined, bearing a cauline leaf below, and often bearing 1(–2) green to membranous sheathing bract-leaves, unbranched. *Spike* flexuose (1–)2–5-flowered; *bracts* 7–11 mm long, herbaceous, with hyaline margin, the outer obtuse, the inner membranous, slightly shorter than the outer. *Flowers* hypocrateriform, pale to deep pink, with a red mark at the base of each tepal; *perianth tube* cylindric, 13–15 mm long, well-exserted, including the stamens and style; *tepals* 12–14 mm long, ovoid, spreading, outer up to 7 mm wide, inner 6 mm wide. *Filaments* ca. 1 mm long, inserted 1.5–2 mm above the base of the perianth tube; *anthers* ca. 3 mm long, included in the tube, and not extending beyond the middle of the tube. *Ovary* 2–3 mm long, *style* very short, less than 1 mm long with 3 short branches. *Capsule* obovoid, 5–6 mm long; *seeds* angular. *Chromosome number*, $2n = 26$ (Goldblatt 5145).

Flowering time. Mid-October to November.

Distribution. Cedarberg, high altitudes on south-facing slopes, in rock seams or under boulders. Figure 37.

Geissorhiza cedarmontana and its less well known ally *G. esterhuyseniae* are unique in the genus in having both stamens and style branches entirely included within the long perianth tube. They appear to be quite isolated in subgenus *Weihea*, with no close allies and have been assigned to a separate section, *Includanthera*. Of the two species, *Geissorhiza cedarmontana* seems the more specialized, having very short filaments, ca. 1 mm long, inserted about 2 mm above the base of the perianth tube and a style less than 1 mm long, with three short poorly defined branches. The leaves are also modified, having much thickened margins and midrib, so that two longitudinal grooves run the length of each leaf surface. By contrast, *G. esterhuyseniae* has filaments about 3 mm long, inserted ca. 2.5 mm above the base of the perianth tube, and better developed style branches some 2 mm long. The leaves of *G. esterhuyseniae* are flat, with unthickened margins and midrib.

Both species occupy a similar habitat, growing at high altitudes, above 1,200 m, in sheltered south facing slopes and cliffs, often in cracks in rock faces, or under overhangs, where water is available for longer periods than in open areas. *Geissorhiza cedarmontana* blooms unusually late in the season, late spring to early summer, long

after the last winter rains have fallen in the comparatively dry Cedarberg Mountains. It is known from a rather restricted area of the Cedarberg, in the Middelberg above Algeria, which is much frequented by hikers, but is quite likely more widespread, occurring in places seldom visited.

The character of included stamens and styles found in *Geissorhiza cedarmontana* and *G. esterhuyseniae* occurs in two species of the related genus *Hesperantha*, *H. elsiae* and *H. cedarmontana* and in *Ixia paniculata*. These species are also found in montane or occasionally lowland habitats in the western Cape mountains. It seems likely that their shared floral characters are an adaptation to some specialized pollinator, as yet unidentified.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cedarberg (AC), *Jackson s.n.* (SAM 68438); Middelberg, ca. 5,000 ft., *Jackson s.n.* (NBG 60731); S facing slopes of Middelberg Central, in seams in rock, Goldblatt 5145 (K, MO, NBG, PRE, S, WAG); moist ledges near summit, Cedarberg above Algeria, Galpin 10560 (PRE).

SECTION ANGUSTIFOLIA

5. Section *Angustifolia* Goldbl., sect. nov. TYPE: *G. humilis* (Thunb.) Ker.

Geissorhiza subsection *Filiformes* Foster, Contr. Gray Herb. 135: 18. 1941. TYPE: *G. juncea* (Link) A. Dietr.

Tunicae cormi durae lignosae, interdum molles, foliis 2–3, raro 1, ensiformibus vel linearibus et marginibus costisque incrassatis, vel teretibus, bracteis herbaceis vel membranaceis, saepe siccis supra, floribus actinomorpha, plerumque stellatis, tubo brevi, ad apicem bractearum extenso, vel longissimo.

Corm tunics hard and woody, occasionally soft in texture, *leaves* with the margins and midrib heavily thickened, ensiform to linear, sometimes terete, *bracts* herbaceous to membranous often dry above, *flowers* usually stellate, actinomorphic, the tube short, reaching to the apex of the bracts, or very long.

Species. 11.

25. *Geissorhiza lithicola* Goldbl., sp. nov. TYPE: South Africa. Cape: between Kogelberg and Steenbras, *Esterhuysen* 35262 (holotype, BOL; isotypes, K, MO, PRE, S, WAG). FIGURE 38.

Planta 15–30 cm alta, tunicis cormi concentricis duris, foliis 3, inferioribus duobus linearibus quadrisulcatis, superiore infra vaginanti, caule erecto, spica 1–4 florum, floribus caeruleo-purpureis, tubo 7–8 mm



FIGURE 38. Morphology and distribution of *Geissorhiza lithicola*. Habit and corm $\times 0.5$; flower life size; partial flower and gynoecium $\times 2$ (Esterhuysen 35262, between Kogelberg and Steenbras Mts.).

longo, tepalis 15–20 mm longis, antheris ca. 5 mm longis.

Plants 15–30 cm high. *Corm* globose, flattened obliquely below, 6–10 mm diam., tunics concentric, light brown, woody, drawn into cusps above. *Cataphyll* membranous, decaying early, or not evident. *Leaves* 3 (rarely 2), linear, 1–2 mm wide, with 2 narrow grooves on each surface, the margins and midrib much thickened and minutely ciliate along their edges, the lowermost longest, basal, sticky in the lower half and densely covered with adhering sand, about half to as long as the stem, the middle leaf inserted at or near ground level, sheathing the lower part of the stem for a short distance, the uppermost leaf inserted in the mid part of the stem and partly sheathing below. *Stem* nearly erect, unbranched. *Spike* flexuose, 1–4-flowered; *bracts* 9–11 mm long, herbaceous below, becoming dry above, the in-

ner shorter and narrower than the outer. *Flower* hypocrateriform, the tepals extended horizontally when fully open, purple to violet; *perianth tube* 7–8 mm long, reaching to about the apex of the bracts; *tepals* 15–20 mm long, oblanceolate, to 7–9 mm wide. *Filaments* 6–7 mm long; *anthers* ca. 5 mm long, pollen yellow. *Ovary* 2–3 mm long, *style* dividing near the apex of the anthers, becoming eccentric, branches 3–4 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. October.

Distribution. Middle altitudes in the Kogelberg Mountains. Figure 38.

Geissorhiza lithicola seems to be a link between sections *Angustifolia* and *Engysiphon* of subgenus *Weihea*. It has the hard, woody corm tunics characteristic of section *Engysiphon*, but

an actinomorphic, short-tubed flower, quite typical of section *Angustifolia*. Without the corms it is easily confused with *G. hesperanthoides* and *G. nubigena* of section *Ixiopsis*, both of which species have soft membranous to fibrous tunics. *Geissorhiza lithicola* can be distinguished from these two species by its more lightly thickened leaves, which have minutely ciliate edges. It also has a much shorter perianth tube than *G. nubigena* in which the tube is some 10–18 mm long and at anthesis well exerted from the bracts. The perianth tube of *G. hesperanthoides* is only 5–8 mm long at anthesis, extending to 7–10 mm in older flowers and typically not or barely exerted from the bracts, and confusion with this species is more likely. *Geissorhiza lithicola* is apparently restricted to the Kogelberg Mountains on the east side of False Bay, where it has only been collected twice, at low to middle elevations in very stony ground.

Specimens examined. SOUTH AFRICA. CAPE: 3418 (Simonstown) between Kogelberg and Steenbras (BB), *Esterhuysen* 35262 (BOL, K, MO, PRE, S, WAG); Koeelbaai, *Loubser* 959 (NBG).

26. *Geissorhiza purpurascens* Goldbl., sp. nov.
 TYPE: South Africa. Cape: Mamre road, *Barker* 808 (holotype, NBG). FIGURE 39.

Planta (14–)18–30 cm alta, tunicis cormi concentricis, foliis 3, inferioribus duobus basalibus, linearibus marginibus costisque incrassatis quadricanaliculatis viscosis, superiore vaginanti infra vel omnino, caule erecto simplici vel 1-ramoso, spica 4–9 floribus, floribus stellatis, malvinis, tubo 3–4(–6) mm longo, tepalis 10–16 mm longis, antheris 3.5–4 mm longis, stylo diviso ad apicem antherarum, ramis recurvatis.

Plants (14–)18–30 cm high. *Corm* asymmetric, globose, with one side flattened below and produced downwards shortly, 6–8 mm diam., tunics concentric, pale brown, fragmenting irregularly and drawn into points above. *Cataphyll* membranous. *Leaves* 3 (or 2 if uppermost entirely sheathing and bract-like), the lower two basal, the lowermost longest, about half as long as the stem, sometimes longer, 2–3(–5) mm wide, sticky and with adhering sand, linear, margins and midrib thickened, broadly 2-channelled on each surface, the margins and the edges of the

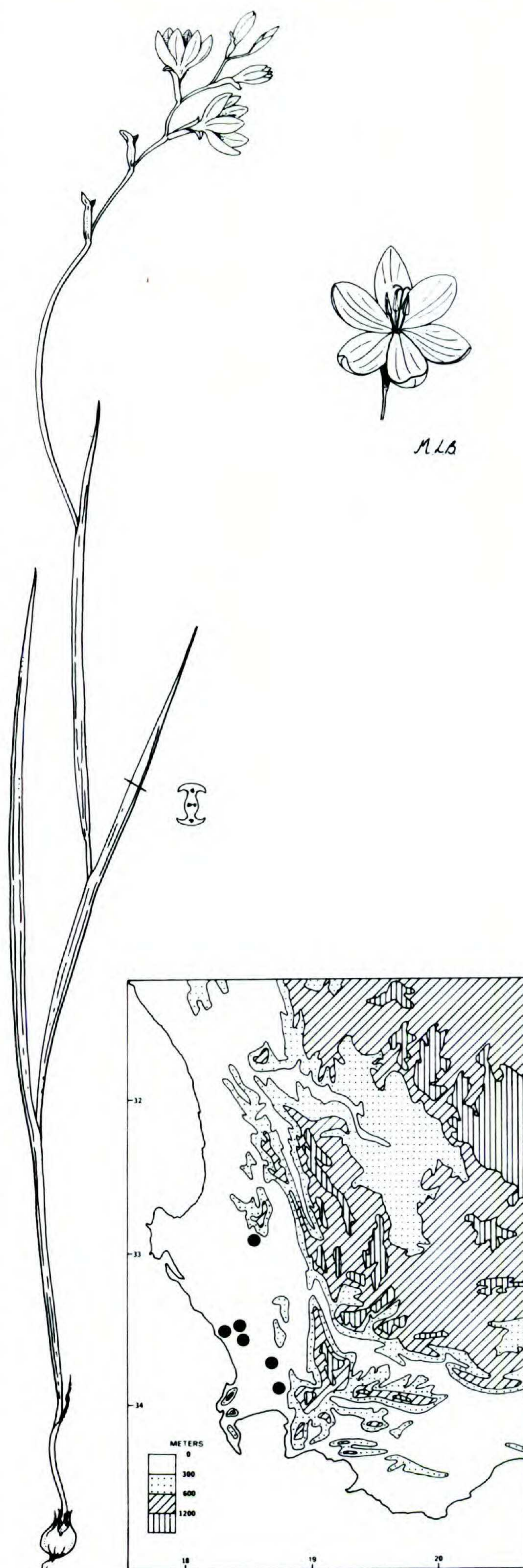


FIGURE 39. Morphology and distribution of *Geissorhiza purpurascens*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt s.n.*, Darling Flower Show, origin unknown).

midrib ciliate-pubescent, the second leaf similar but shorter and sheathing the stem below, the third leaf inserted in the middle part of the stem, partly to almost entirely sheathing. *Stem* erect, simple or with 1 branch, flexed above sheathing part of leaves. *Spike* 4–10-flowered, secund, drooping in bud, flexed at the base and flexuose; *bracts* 6–9 mm long, initially herbaceous with a hyaline margin, later dry and pale in upper half or entirely, the inner shorter than the outer. *Flower* stellate, pale mauve (darkening when dry); *perianth tube* 3–4(–6) mm long; *tepals* 10–16 mm long, 6–8 mm wide, elliptic. *Filaments* 4–6 mm long; *anthers* 3.5–4 mm long. *Ovary* 2 mm long, *style* dividing near the apex of the anthers, branches ca. 2.5 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to early October.

Distribution. Local on the west coast between Paarl Mountain and the coast at Mamre and Darling. Figure 39.

Geissorhiza purpurascens is a member of subgenus *Weihea*, and has the hard, concentric corm tunics typical of this group. It is allied to *G. juncea* and is very similar to this species in general appearance, but differs in having pale mauve flowers, linear leaves with raised margins and midrib, more or less oblong in section and considerably larger flowers than are typically found in *G. juncea* which has terete leaves and white-, cream-, or yellow-colored flowers. *Geissorhiza purpurascens* is apparently a rare endemic of sandy soils between Stellenbosch and the coast at Mamre and Darling, where it has been collected at Bokbaai. It occasionally appears as an exhibit on the Darling Wild Flower Show, as it did in September 1981, when I obtained a live plant for description and illustration. Its habitat has not been recorded, but I was told that it grew in damp low lying places and on the edge of vleis. A search for the species which I made in 1981 proved futile. It must be considered endangered and further efforts should be made to discover and learn more about the species before it is lost.

A collection from the south slopes of the Piketberg, Loubser 2177, appears to belong here but it is unusual in having very broad leaves, to 5 mm wide, and flowers with a somewhat longer perianth tube than the populations to the south, which have leaves only 2–3 mm wide. The Piketberg population is reported to grow in stony well-drained soil.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Piketberg, along the road to Velddrif (DC), Loubser 2177 (BOL).

3318 (Cape Town) Mamre hills (AD), van Niekerk 258 (NBG); Mamre road (CB-DA), Barker 808 (NBG); Bokbaai (CB), Joubert 550 (PRE, STE); Burgers Pos farm near Pella, well-drained sand (DA), Boucher & Shepherd 4815 (STE); Agter Paarl (DC), Barker 402 (NBG); near Bottelary road, sandy soil (DC-DD), Acocks 2163 (S).

WITHOUT PRECISE LOCALITY: Darling Flower Show, 1982, Goldblatt s.n. (MO).

27. *Geissorhiza humilis* (Thunb.) Ker, Ann. Bot. (König & Sims) 1: 242. 1804; Lewis, Fl. Cape Penins. 254. 1950. *Ixia humilis* Thunb., Diss. de *Ixia* no. 4: 141. 1783. TYPE: South Africa. Cape: hills around Cape Town, Thunberg s.n. "*I. humilis* α " [lectotype, Herb. Thunb. 959 UPS, designated by Brown (1928); isolectotype, Montin"] S "Herb. Casstrom, Herb. [*I. humilis* β , γ , and δ are different species (Goldblatt, 1982)]. FIGURE 40.

Geissorhiza humilis var. *humilis*, Baker, Fl. Cap. 6: 67. 1896, pro parte; Foster, Contr. Gray Herb. 135: 18. 1941.

Geissorhiza humilis var. *grandiflora* Baker, Handb. Irid. 153. 1892, Fl. Cap. 6: 67. 1896. TYPE: South Africa. Cape: fields near Claremont, H. Bolus 4602 (lectotype, K, here designated; isolectotypes, BM, BOL, SAM); Niven s.n. (syntype, not seen); Cape flats Pappe s.n. (syntype, BM).

Plants short, 8–14 cm high. *Corm* asymmetric, ovoid, obliquely flattened below, projecting downward for a short distance, tunics light brown, concentric, fragmenting irregularly, drawn into bristles above. *Cataphyll* membranous, sometimes apparently lacking. *Leaves* 2–3, lowermost basal and longest, falcate, longer than the stem, the margins and midrib thickened and with 2 narrow grooves running the length of each surface, a second basal leaf often present and similar but smaller, the third leaf basal or more often cauline, sheathing below, ribbed, sometimes much reduced and becoming bract-like, all leaves (and bracts) sticky, and with sand adhering even when dry. *Stem* inclined, flexed above the base, rarely with a single branch. *Spike* 2–8-flowered, flexuose; *bracts* green, 8–12 mm long, lightly ribbed, margins hyaline, truncate, the inner as long, but smaller than the outer, sticky, and often covered with sand. *Flower* stellate, tepals spread horizontally when fully open, bright yellow; *perianth tube* 5–6 mm long, widening slightly at base, usually just exerted from bracts; *tepals* obovate,

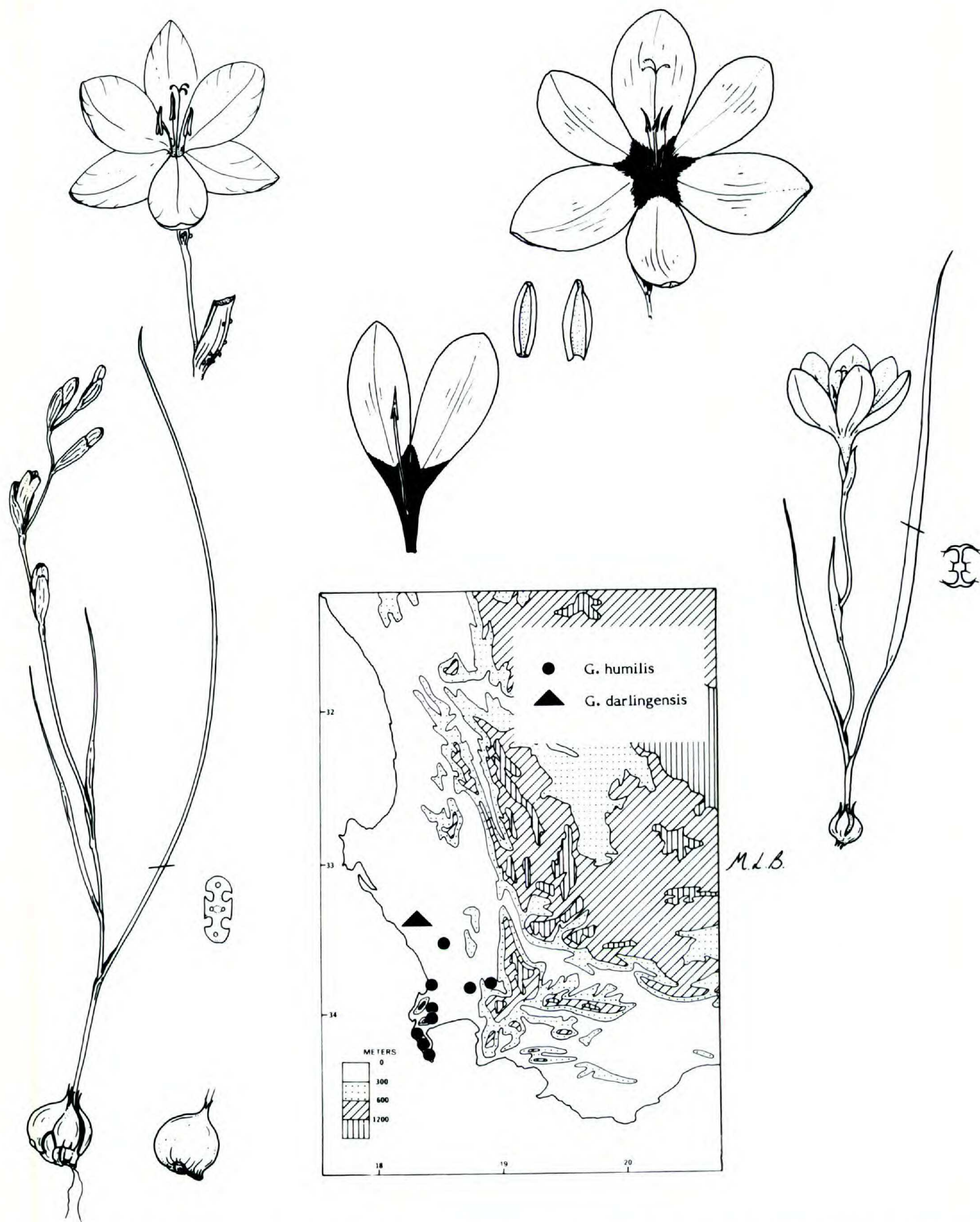


FIGURE 40. Morphology and distribution of *Geissorhiza humilis* (left) and *G. darlingensis* (right). Habits and corm $\times 0.5$; flowers, separated bracts, and tepals life size; leaf sections much enlarged (*G. humilis*, flowering Goldblatt 4125, near Kommetje, fruiting Goldblatt 5265, foot of Klaasjagersberg; *G. darlingensis*, Roux s.n., Versveld Reserve, Darling, ex hort.).

16–22 mm long, to 14 mm wide. *Filaments* ca. 5 mm long, erect; *anthers* ca. 5 mm long, yellow. *Ovary* 2–3 mm long; *style* dividing towards the apex of the anthers, branches 3–4 mm long, re-

curved. *Capsule* oblong-cylindric, (8–)10–12 mm long, shorter than or just exceeding the bracts, apparently dehiscent in the upper part only. *Chromosome number*, $2n = 26$ (Goldblatt 5265).

Flowering time. Late August to October.

Distribution. Sandy flats and mountain plateaus, Cape Peninsula and locally north across the Cape Flats. Figure 40.

Geissorhiza humilis is a rare species restricted to the Cape Peninsula and surrounding Cape Flats extending as far inland as Simondium, near Paarl. It grows on coarse sandy soil and flowers well only in the season following a veld fire when its golden yellow flowers make a conspicuous display. *Geissorhiza humilis* and the related smaller flowered *G. hispidula* grow together at several sites on the Cape Peninsula, and often flower at the same time. They are clearly quite different species when seen alive, although vegetative parts are difficult to distinguish, but the two have long been confused. *Geissorhiza hispidula* has until now been regarded either as a paler flowered form or as a distinct variety of *G. humilis*. Baker placed specimens regarded here as *G. humilis* in both *G. humilis* var. *humilis* and var. *grandiflora* while treating *G. hispidula* either as *G. humilis* var. *bicolor* or var. *humilis*. Foster, however, clearly distinguished the two and treated the smaller flowered and paler colored plants as var. *hispidula* or var. *bicolor*. Both varieties are here placed in *G. hispidula* (Foster) Goldbl.

Geissorhiza humilis has comparatively large golden yellow flowers with tepals to 22 mm long and a tube 5–6 mm long. The spikes may have as many as eight flowers, but more often plants are shorter and have fewer blooms. In contrast, *G. hispidula* has smaller cream-colored flowers, conspicuously marked red on the reverse of the outer tepals. The tepals are 10–15 mm long and the tube 3–4 mm long while the spikes usually have 2–5 flowers.

Geissorhiza darlingensis, a poorly known endemic of the Darling area to the north of the Cape Peninsula, is clearly closely allied to *G. humilis* and appears to be a local segregate of this species. *Geissorhiza darlingensis* has larger flowers that have tepals 23–26 mm long and a tube 9–11 mm long. The bright yellow flowers have a conspicuous dark center and this together with their large size makes the species easy to distinguish from *G. humilis*. A particularly robust form of *G. humilis* from Riverlands near Dassenberg, *Burgers* 2595, approaches *G. darlingensis* and appears to be intermediate between the two species. However, the flower does not have the dark center characteristic of the latter.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) fields near Claremont, Cape Town (CD), *H. Bolus* 4602 (BM, BOL, K, SAM); Claremont, *Dümmmer* 436 (E), 327 (E), *Salter* 2772 (BM); Kenilworth Race Course, *Lewis* 55 (SAM); flats near Blaauwberg, *Zeyher* 428 (SAM); Wynberg, *Schlechter* 1559 (B, G, M, W, Z); Riverlands near Dassenberg, sandy flats (DA), *Burgers* 2595 (STE); Simondium (DD), *Stanford* s.n. (BOL 31903); Bottelary road, towards Railway, *Acocks* 818 (S).

3319 (Simonstown), sandy slopes near Kommetje (AB), *Goldblatt* 4125 (K, MO, PRE); Bergvliet farm, *Purcell* s.n. (SAM 93390); Klein Slangkop, *Wolley Dod* 3033 (K, MO); Tokai, *Guthrie* 1096 (BOL); S Peninsula, *Goldblatt* 447 (BOL); Fish Hoek flats, *Levy's* s.n. (CT); Fish Hoek, *Wolley Dod* 1616 (BOL, K); Bonteberg, Cape Peninsula, *Barker* 816 (NBG); lower slopes of Klaasjagersberg, opposite Reserve, *Goldblatt* 5265 (K, MO, NBG); Redhill, Simonstown, *Taylor* 5247 (PRE); Simons Bay, *Wright* 253 (GH, K); near Smitwinkel Bay (AD), *Hutchinson* 670 (K); Smitwinkel Ridge, *Salter* 331/17 (BM); Olifantsbos, *Lewis* 1075 (SAM); Cape Flats (BA), *Zeyher* 3964 (K, SAM), *Pappe* s.n. (BM, K); Krom River, Cape Peninsula, *Barker* 3880 (BOL, NBG); Kogelfontein, Cape Point Reserve, *Taylor* 10025 (MO, STE).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, *Bowie* s.n. (G); Hottentots Holland and Cape Flats, *Bowie* s.n. (BM), *Thunberg* s.n. "*Ixia setacea* β " (UPS), *Niven* s.n. (K).

28. *Geissorhiza darlingensis* Goldbl., sp. nov.

TYPE: South Africa. Cape: Versveld Flower Reserve, Darling, cult. Nat. Bot. Gard., *Roux* s.n. (holotype, NBG; isotype, MO). FIGURE 40.

Planta 7–15 cm alta, tunicis cormi concentricis, foliis 3, duobus inferioribus basalibus, linearibus 4-sulcatisque, superiore infra caulem vaginante, spica 2–5 florum, floribus campanulatis, luteis centralibus atropurpureis, tubo 8–11 mm longo, tepalis 23–26 mm longis, antheris ca. 5 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants 7–15 cm high. *Corm* more or less symmetric, 5–8 mm diam., tunics pale brown, fragmenting irregularly, drawn into points above. *Cataphyll* membranous. *Leaves* 3, the lower two basal, linear, 2–3 mm wide, the margins and midrib much enlarged and minutely ciliate along the edges, with 2 wide grooves running the length of the leaf, slightly sticky and with some sand adhering, the lowermost longest, exceeding the spike, the uppermost leaf inserted on the stem above the ground, inflated and sheathing below, linear above. *Stem* erect below, flexed above the cauline leaf sheath and inclined, simple or with 1–2 branches. *Spike* 2–5-flowered, flexed at the base; *bracts* herbaceous, 10–15 mm or more,

truncate, the inner smaller. *Flower* somewhat cupped, pale yellow with a dark purple center; *perianth tube* nearly cylindric, 9–11 mm long, usually shortly exerted from the bracts; *tepals* 23–26 mm long, obovate, to 12 mm wide. *Filaments* 8–9 mm long; *anthers* 5 mm long, yellow. *Ovary* 2–3 mm long, *style* dividing near the apex of the anthers, branches 3 mm long, recurved. *Capsule* oblong, truncate, 10–12 mm long. *Chromosome number*, unknown.

Flowering time. Late September to mid-October.

Distribution. Damp sandy soil, known only from the Flora Reserve at Darling. Figure 40.

This striking species is apparently endemic to a small area near the town of Darling, north of Cape Town. It has been collected only rarely by both W. F. Barker and G. J. Lewis, on the same day in the Flora Reserve just outside Darling and years later by J. Roux. The very large pale yellow flower with a purple center is reminiscent of *Babiana pygmaea* (Iridaceae), a species also endemic to this area. This seems to be yet another example of floral mimicry which appears to be a common phenomenon in *Geissorhiza*. *Geissorhiza darlingensis* has a small corm with concentric tunics and clearly belongs in subgenus *Weichea*. It appears to be closely allied to *G. humilis*, a yellow-flowered species which occurs to the south on the Cape Peninsula and on the Cape Flats. *Geissorhiza humilis* has a smaller, self-colored flower, with a shorter perianth tube, and a similar four-grooved leaf which lacks entirely the leaf ciliation characteristic of *G. darlingensis*.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Cape Town) Versveld Flower Reserve, Darling (AD), Barker 8656 (NBG), Lewis 5086 (NBG), Roux s.n. (MO, NBG).

29. *Geissorhiza hispidula* (Foster) Goldbl., comb. et stat. nov. *Geissorhiza humilis* var. *hispidula* Foster, Contr. Gray Herb. 135: 19. 1941; Lewis, Fl. Cape Penins. 255. 1950. TYPE: South Africa. Cape: Cape Flats, Zeyher 1599 (holotype, K; isotypes, B, G, K, SAM). FIGURE 41.

Geissorhiza setacea (Thunb.) Ker sensu Ker, Bot. Mag. 31: tab. 1255. 1810.

Geissorhiza humilis var. *bicolor* Baker, Handb. Irid. 153. 1892, Fl. Cap. 6: 67. 1896; Foster, Contr. Gray Herb. 135: 19. 1941; Lewis, Fl. Cape Penins. 255. 1950. TYPE: South Africa. Cape: Muizenberg,

MacOwan s.n. in Herb. Norm. Aust. Afr. 257 (lectotype, K; isolectotypes, B, BOL, G, SAM; syntypes, see Fl. Cap. 6: 67. 1896).

Geissorhiza plicata Pappe ms. (Zeyher 1599).

Geissorhiza brehmii Ecklon ms. [Zeyher 1599 (78.9)].

Geissorhiza striata Ecklon ms. (Ecklon & Zeyher Irid. 296).

Plants small, 7–15(–25) cm high. *Corm* asymmetric, ovoid, 5–7 mm diam., base obliquely flattened on one side, sometimes extending downward shortly, tunics concentric, woody, brown. *Cataphyll* solitary, membranous. *Leaves* 3, rarely 2, the lower two longest, basal, erect to falcate, linear, 1–2 mm wide, slightly longer than the stem, margins and midrib much enlarged, with 2 narrow grooves running the length of each surface, edges of margin and midrib smooth or minutely ciliate, leaves and bracts often sticky, and with sand adhering even when dry, the lowermost longest, the uppermost cauline, usually short and sheathing below, sheathing part ribbed, and sometimes also ciliate along ridges. *Stem* more or less erect, rarely branched, bearing a single small, sometimes bract-like leaf. *Spike* 1–5-flowered, flexuose; *bracts* herbaceous with a hyaline or reddish margin, 7–9 mm long, sticky, the inner shorter than the outer. *Flower* stellate, white to cream, often with the reverse of outer tepals pink to red-flushed, tepals spreading when fully open; *perianth tube* 3–4 mm long, shorter than or just longer than the bracts; *tepals* 10–15 mm long, narrowly obovate, 5–8 mm wide. *Filaments* 3–4 mm long, erect; *anthers* yellow, ca. 3 mm long. *Ovary* 2–3 mm long, *style* dividing at the apex of the anthers, branches 2.5–3 mm long, recurved. *Capsule* obovoid to oblong, 5–8 mm long, exceeding the bracts, dehiscent at least to midline. *Chromosome number*, $2n = 26$ (Goldblatt 5377).

Flowering time. August to September.

Distribution. Cape Peninsula east to the Riversdale district, in sandy soil, usually on flats or mountain plateaus and flowering only in the season after a fire. Figure 41.

Geissorhiza hispidula has a relatively wide distribution extending from the Cape Peninsula east to the Riversdale district but it is common only in the west, where it is frequently found in sandy flat areas in the season following a veld fire. It has often been confused with the related *G. juncea* and *G. humilis* and both Baker (1892, 1896) and Foster (1941) included it as a variety of *G.*

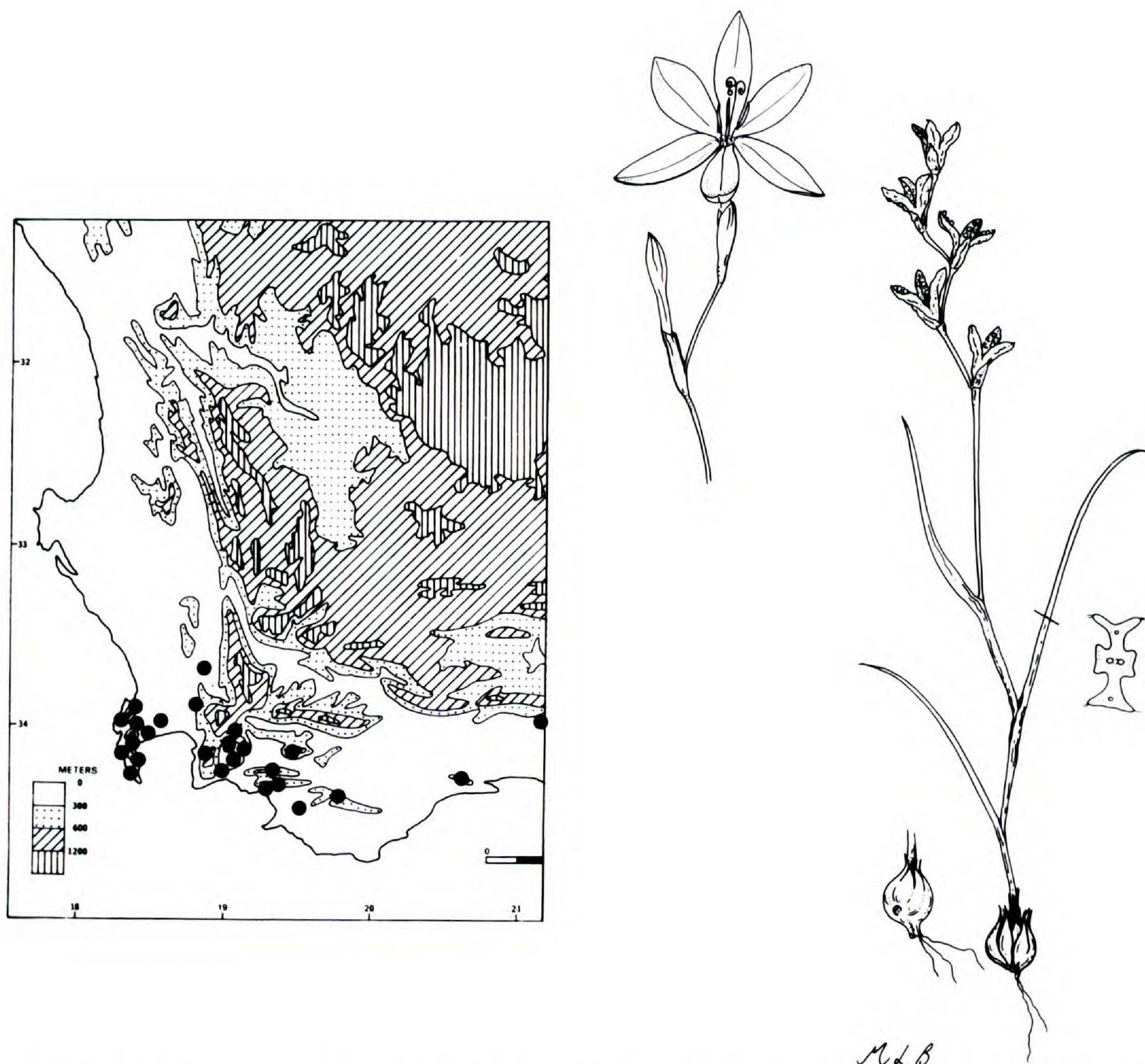


FIGURE 41. Morphology and distribution of *Geissorhiza hispidula*. Corm, fruiting, and flowering plants life size; leaf section much enlarged (fruiting Goldblatt 5266, foot of Klaasjagersberg, flowering Goldblatt 4126, near Kommetje).

humilis. Baker was particularly confused about the species and cited specimens of *G. hispidula* under *G. humilis* var. *humilis* and var. *grandiflora*, the latter corresponding exactly to the type of *G. humilis*. Foster clearly distinguished it from var. *humilis*, but assigned specimens here referred to *G. hispidula* to two nearly identical varieties, var. *hispidula* and var. *bicolor*, the latter differing only in having the leaf margins smooth rather than minutely ciliate-hispid. Careful examination of material Foster placed in var. *bicolor* has revealed that he failed to observe very inconspicuous cilia in some specimens. I prefer not to recognize the two varieties as the presence or absence of minute leaf ciliation seems a trivial distinction.

There seems little doubt that *Geissorhiza hispidula* is quite distinct from *G. humilis*. The latter has larger bright yellow flowers, is generally more robust and has broader leaves and it can readily be distinguished from *G. hispidula* on these characters (see discussion under *G. humilis*). Both species occur together at several places on the Cape Peninsula and although they flower simultaneously, they remain distinct from one another. When seen alive, it becomes clear that they are separate, although related species.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Table Mt., lower plateau (CD), *Wolley Dod* 1774 (BOL), *Goldblatt* 6725 (MO); Table Mt., Weather Station, *Werdermann & Oberdieck* 17 (B, K, PRE); lower slopes above Camps Bay, *Lewis* 1199

(SAM); Raapenberg, Mowbray, *Guthrie 1095* (BOL); Claremont, *Schlechter 1568* (B, G, W, Z); E end of Table Mt. near Constantia, *Ecklon & Zeyher Irid. 296* (FI, MO); Wynberg flats, *Prior s.n.* (K); between Paarl and Pont (DB), *Drège 8475* (K); Stellenbosch flats (DD), *Garside 1066* (K).

3418 (Simonstown) Bergvliet (AB), *Purcell s.n.* (SAM 90342, 93391); lower slopes of Klaasjagersberg, opposite Cape Point Reserve, *Goldblatt 5266* (MO, PRE); sandy slopes near Kommetje, *Goldblatt 4126* (K, MO, PRE, US, WAG); near marsh at source of Slangkop River, *Wolley Dod 3190* (BM, BOL, K); Constantia corner, *Pillans 10776* (MO), *Salter 9483* (BM); Simonstown, *Zeyher 114* (BOL, SAM); top of Muizenberg Mt., *MacOwan s.n.* (or 2474) *Herb. Norm. Aust. Afr. 257* (B, BM, BOL, G, GH, K, SAM), *MacOwan 2474* (S); Steenberg plateau, *Lewis 1198* [PRE (as SAM 57331), SAM], *Compton 13642* (NBG); Redhill, Simonstown, *Taylor 5246* (PRE), *Lewis s.n.* (PRE, SAM 61718, STE); near Cirkels Vlei, Cape Point Reserve (AD), *Lewis 1200* (SAM); Wynberg flats (BA), *Marloth 7162* (PRE), *Prior s.n.* (GH); Cape Flats, *Zeyher 1599* (B, BM, FI, G, K, P, S, SAM, W, Z); Kogelberg (BB), *Stokoe s.n.* (SAM 59846); Palmiet River mouth (BD), *Gillett 4236* (MO).

3419 (Caledon) foot of Houw Hoek Pass (AA), *Goldblatt 5639* (MO); foot of Viljoens Pass at Elgin, *Gillett 4459* (BOL); above Houw Hoek, *Gillett 4287* (BOL, K); Zwartberg, Caledon, 2,500 ft. (AB), *Galpin 4672* (PRE); Shaws Mt., *Barker 8* (BOL, K); Highlands Forest Reserve (AC), *Leighton 279* (BOL), *Compton 13481* (NBG), *Goldblatt 4783* (MO); Lebanon Forest Reserve, catchment IId, *Kruger 487* (STE, PRE); Fernkloof Nature Reserve, Hermanus (AD), *Orchard 280* (BR, K, S, STE), 483 (MO); Hermanus, E side of the Vogelgat River, *S. Williams 840* (MO), *Goldblatt 7034* (MO); Sandys Glen, burned area (BD), *Goldblatt 4849A* (MO, WAG); Papiesvlei fynbos, *Acocks 22791* (PRE); farm Paardeberg, Papiesvlei, *Taylor 4055* (PRE); Strandkooft (CB), *Compton 21971* (NBG).

3420 (Bredasdorp) Potberg Mt., upper slopes in black sand (BC), *Burgers 2446* (STE).

3421 (Riversdale) summit of hills behind Albertinia (BA), *Muir 1835* (BOL).

WITHOUT PRECISE LOCALITY: South Africa, *Sieber 395* (MO); Capstadt, *Spielhaus 1877* (B); Cap. Bonae Spei, *Lalande s.n.* (B).

- 30. *Geissorhiza pappei* Baker, Handb. Irid. 154. 1892, Fl. Cap. 6: 68–69. 1896; Foster, Contr. Gray Herb. 135: 20–21. 1941. TYPE: South Africa. Cape: Zonder Einde Mts., *Zeyher 3965* [lectotype, K; designated by Foster (1941); isoelectotypes, B, SAM]; *Pappe s.n.*, *Zeyher 3967* (syntypes, not seen).**

Plants small, 5–10 cm high. *Corm* asymmetric, ovoid, 5–7 mm diam., the base obliquely flattened on one side, tunics concentric, soft and papery, light brown. *Cataphyll* solitary, membranous, sticky and usually covered with sand. *Leaves* 3, rarely 2, the lower two basal, erect to falcate, linear, 0.5–1.3 mm wide, the margins and

midrib somewhat to much enlarged and then with 2 narrow grooves running the length of each surface, the edges of margin and midrib evidently smooth, leaves (and bracts) often sticky and with sand adhering even when dry, the lowermost leaf longest and somewhat longer than the stem, the second shorter, the uppermost cauline, usually short and sheathing below, occasionally reduced and bract-like, the sheathing part ribbed. *Stem* more or less erect, rarely branched, bearing a single small, sometimes bract-like, leaf. *Spike* 1–4-flowered, flexuose; *bracts* herbaceous, hyaline above, 3–6 mm long, the inner shorter than the outer. *Flower* stellate, white to cream, tepals spreading when fully open; *perianth tube* 2.5–3.5 mm long, shorter than or just longer than the bracts; *tepals* 6–9 mm long, narrowly obovate, 2.5–4 mm wide. *Filaments* ca. 2 mm long, erect; *anthers* yellow, ca. 2 mm long. *Ovary* 1.5–2 mm long, *style* dividing at the apex of the anthers, branches to 0.7 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to early October.

Distribution. Apparently rare and local in the southwestern Cape, from Riviersonderend in the east to Ceres in the north, in sandy soil. Figure 42.

There is some doubt whether *Geissorhiza pappei* is distinct from the more widespread and common *G. hispidula*. This species has larger, cream to yellow flowers, usually marked red on the reverse of the outer tepals, is generally more robust and has broader leaves and larger corms with brittle woody tunics. While *G. pappei* can readily be distinguished from *G. hispidula* by comparing these characters, there is a possibility that *G. pappei* may be simply a depauperate form of the more robust *G. hispidula*. Baker (1892), who described the species in his “Handbook of the Irideae,” continued to recognize it in “Flora Capensis” (1896) and Foster (1941) also included it in his monograph of the genus. While I have doubts about its status, I prefer not to alter the current treatment until more evidence becomes available.

Geissorhiza pappei has a limited distribution in the southwestern Cape. It has been collected near Riviersonderend, at Highlands in the Caledon district and at Ceres. It is probably more common than the record indicates but it is very inconspicuous and it may often have been overlooked.

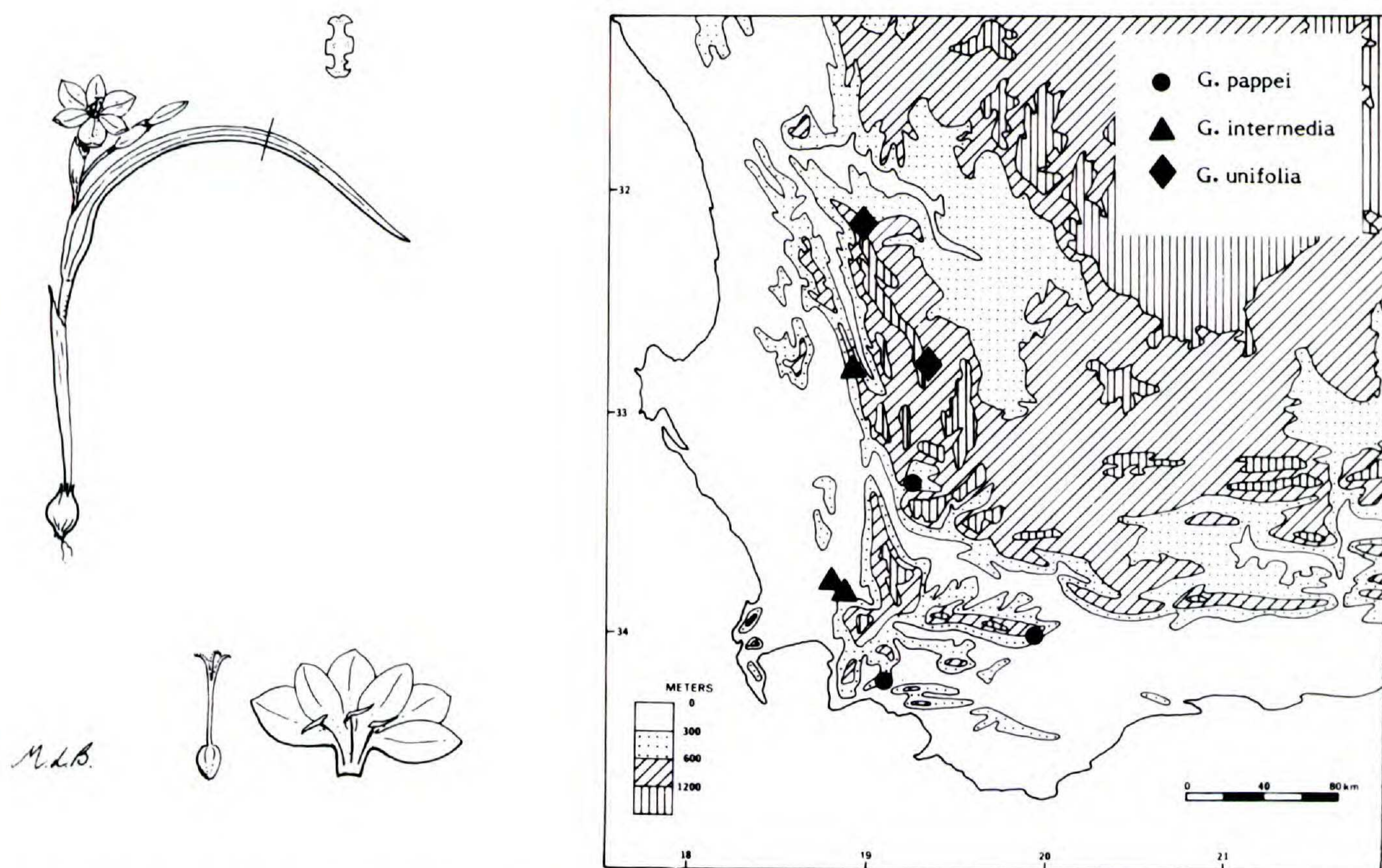


FIGURE 42. Morphology of *Geissorhiza unifolia* and distribution of *G. pappei*, *G. intermedia*, and *G. unifolia*. Habit life size; flower and gynoecium $\times 2$; leaf section much enlarged (Esterhuysen 36128, Bokkeveld Sneeuberg).

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Ceres, foot of mt. near village (AD), *Marloth* 12996 (PRE).

3419 (Caledon) Highlands (AC), *Compton* 13480 (NBG); Zonder Einde Mts. (BB), *Zeyher* 3965 (B, K, SAM).

31. *Geissorhiza intermedia* Goldbl., sp. nov.
 TYPE: South Africa. Cape: Banhoek, Spitzkop, 4,000 ft., *Esterhuysen* 11887 (holotype, BOL).

Planta 5–12 cm alta, foliis 3, inferiore longissimo, basali, 1.5–3.5 mm lato, marginibus et costis incrassatis quadrisulcatisque, superiore infra caulem vaginante, caule erecto ciliato raro ramoso, spica 1–3 florum, floribus stellatis albis, tubo ca. 3 mm longo, tepalis 8–10 mm longis, antheris 2–3 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants small, 5–12 cm high. *Corm* ovoid, 5–7 mm diam., tunics concentric, firm textured, light brown. *Cataphyll* solitary, membranous. *Leaves* 3, erect and ensiform or falcate, 1.5–3.5 mm wide, about as long as the stem, the margins and midrib enlarged and with 2 broad grooves running the length of each surface, the margin and midrib edges evidently smooth (but sometimes sparsely and minutely ciliate), the lower two leaves basal, the lowermost longest and often slightly sticky below and on the sheath, and with sand adhering

even when dry, the second much shorter, the uppermost leaf smallest, cauline, sheathing below. *Stem* minutely and densely ciliate above the uppermost leaf, more or less erect, rarely branched. *Spike* 1–3-flowered, flexuose; *bracts* herbaceous, hyaline above, 6–9 mm long, the inner 1–2 mm shorter than the outer. *Flower* stellate, white, tepals spreading when fully open; *perianth tube* 2–3 mm long, not reaching the apex of the bracts; *tepals* 8–10 mm long, narrowly obovate, ca. 4 mm wide. *Filaments* ca. 4 mm long, erect; *anthers* yellow, 2–3 mm long. *Ovary* ca. 2 mm long, *style* dividing at the apex of the anthers, branches to 2 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to October.

Distribution. Apparently rare and local in the southwestern Cape, recorded only from Banhoek and Simonsberg in the south and on the Twenty Four Rivers Mountains in the north, in sandy soil. Figure 42.

Geissorhiza intermedia is apparently a rare montane species of the southwestern Cape mountains and it is known from only three collections. It stands out in subgenus *Weihea* in its densely ciliate stem, an unusual character in this subgenus. *Geissorhiza intermedia* is otherwise

undistinguished and its white flower with a well-developed perianth tube and narrow leaf with strongly raised margins and midrib are typical of section *Angustifolia*, to which it has been assigned. It can easily be mistaken for the similar and probably closely related *G. hispidula* which has a lowland distribution, and can be distinguished by its narrower, sticky leaf, sticky bracts, and invariably smooth stem. *Geissorhiza intermedia* may also be confused with *G. similis*, which is similar in its leaf and general appearance but has imbricate corm tunics, a longer perianth tube, and also has smooth stems. There is also a strong resemblance between *G. intermedia* and the Cedarberg endemic, *G. ciliatula*, but this species has smaller flowers that turn blue on fading, narrow leaves, the second of which sheaths the stem in its lower half, and is altogether a much more slender plant.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Simonsberg (DD), *Rehm s.n.* (M); Banhoek, Spitzkop, crevices and foot of cliffs, 4,000 ft., *Esterhuysen 11887* (BOL).

3319 (Worcester) Twenty Four Rivers Mts., rocky koppie on plateau (AA), *Esterhuysen 23769* (BOL).

32. *Geissorhiza unifolia* Goldbl., sp. nov. TYPE: South Africa. Cape: N Cedarberg, Peak at Koupoort, *Esterhuysen 12159* (holotype, BOL; isotype, MO). FIGURE 42.

Planta parva 5–10 cm alta, cormis ca. 5 mm diam., tunicis fragilis papyraceis manifeste concentricis, folio uno basali, marginibus costisque incrassatis, caule erecto papilloso-ciliato, bracteam supra ferenti, spica 1–5 florum, floribus stellatis albis, tubo ca. 2 mm longo, tepalis ca. 5 mm longis, antheris ca. 1.8 mm longis, capsula globosa ad 4 mm longa.

Plants small, 5–10 cm high. *Corm* globose, ca. 5 mm diam., tunics pale brown, brittle papery, apparently concentric, notched below and drawn into bristles above. *Cataphyll* membranous, sticky, and with soil adhering. *Leaf* solitary (occasionally 2), basal, sheathing the stem below, linear to falcate, 0.5–1.3 mm wide, the margins and midrib thickened. *Stem* erect, flexed above the leaf sheath, minutely papillate-ciliate especially below, simple, bearing a short, submembranous sheathing bract in the upper third. *Spike* 1–5-flowered, flexuose; *bracts* 3.5–5 mm long, herbaceous below, dry and transparent to light brown above. *Flower* stellate, tiny, white, the outer tepals pink-purple on the reverse; *perianth tube* 1.5–2 mm long, cylindric; *tepals* 3.5–5 mm long, and to 2 mm wide. *Filaments* ca. 2 mm long; *anthers* 1–1.8 mm long. *Ovary* 1.3–2 mm

long, *style* dividing at the midline of the anthers, branches ca. 1 mm long, recurved. *Capsule* globose, to 4 mm long, shorter than bracts. *Chromosome number*, unknown.

Flowering time. October.

Distribution. Local in the Cedarberg and Cold Bokkeveld Mountains, at high elevations on thin soils. Figure 42.

Geissorhiza unifolia is an unusual, dwarf species of the Cedarberg and Cold Bokkeveld Mountains. It is known only from two collections, both made by Elsie Esterhuysen, one in 1945 and the other in 1983. The species is apparently rare and restricted to high altitudes and grows on flat rocky pavement in thin soil and on south-facing slopes on damp ledges and rock cracks. It is easily recognized by its tiny flowers with tepals 5 mm long and single produced leaf. The minutely ciliate stem which bears a short membranous and entirely sheathing bract in the upper third and the sticky cataphyll to which soil adheres even when dry are also unusual features that distinguish the species.

It apparently belongs to subgenus *Weihea*, having concentric corm tunics very like those of *Geissorhiza pappei* in their brittle papery texture. *Geissorhiza unifolia* bears a superficial resemblance to depauperate specimens of *G. scillaris* (subgenus *Geissorhiza*) (e.g., *Stokoe s.n.*, Heuning Vlei) but even such dwarfed individuals of *G. scillaris* consistently have two produced leaves in addition to the characteristic membranous stem bract of this species. The affinities of *G. unifolia* may have to be reassessed when more material becomes available, but for the present it is assigned to section *Angustifolia* close to *G. pappei*.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) N Cedarberg, Peak at Koupoort, damp ledges and crevices on S side (AA), *Esterhuysen 12159* (BOL, K); Bokkeveld Sneeu Berg, 6,600 ft., thin sand on rock pavement (CD), *Esterhuysen 36128* (MO, NBG, PRE).

33. *Geissorhiza juncea* (Link) A. Dietr., Sp. Pl. 6th edition, 2: 587. 1833; Foster, Contr. Gray Herb. 135: 21. 1941. *Ixia juncea* Link, Enum. Hort. Berol. Alt. 1: 50. 1821; Baker, J. Linn. Soc., Bot. 16: 93. 1878. *Geissorhiza humilis* var. *d. juncea* (Link) Baker, Handb. Irid. 153. 1892, Fl. Cap. 6: 67. 1896. TYPE: South Africa. locality unknown: cultivated in Berlin by Link, from material sent to him by Bergius in Stockholm (*Bergius s.n. Ixia*

setacea), Link 1205 "*Ixia juncea* m" [lectotype, B, effectively designated by Foster (1941)]. FIGURE 43.

Geissorhiza filifolia Baker, J. Bot. n.s. 5: 238. 1876, Fl. Cap. 6: 68. 1896. TYPE: South Africa. Cape: precise locality unknown, *Prior s.n.* (or *Alexander s.n.*) (holotype, ? BM, not seen; GH, photo).

Geissorhiza secunda var. *setifolia* Ecklon ex Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 69. 1896. TYPE: South Africa. Cape: between Paarl and Pont, Drège 8460 (lectotype, K, here designated; syntypes, several cited in Fl. Cap. 6: 69. 1896).

Geissorhiza setifolia Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 22. 1827, nom nud.

Geissorhiza pallidiflora Schltr., Bot. Jahrb. Syst. 27: 97. 1899. TYPE: South Africa. Cape: damp sandy flats between Bains Kloof and Wolseley (Ceres Road), Schlechter 9088 (lectotype, B, here designated; isoelectotypes, B, BM, BOL).

Geissorhiza juncea var. *pallidiflora* (Schltr.) Foster non sensu Foster, Contr. Gray Herb. 135: 23. 1941, excl. specimens cited (intended for *G. scillaris* A. Dietr.).

Hesperantha subulata Baker, Bull. Herb. Boissier, Ser. 2, 1: 864. 1901. TYPE: South Africa. Cape: Cape Flats, Rehmann 1850 (lectotype, Z, here designated; isoelectotypes, BM, BR).

Ixia flexuosa L. sensu Thunb. pro parte, Thunberg s.n. (S).

Geissorhiza setacea (Thunb.) Ker sensu Klatt, Linnaea 34: 656. 1866, pro parte.

Plants slender, (7–)20–35(–45) cm high. *Corm* globose, 5–9 mm diam., tunics light brown, concentric, usually woody, the outer layers fractured irregularly, drawn into bristles above. *Cataphyll* dry, single, reaching the above ground, sticky and often covered with sand. *Leaves* usually 3, the lower two basal, terete, erect, reaching to about the middle of the spike, with 4 narrow longitudinal grooves, the third inserted above the ground and sheathing the stem for about half its length, the free upper part 2–4 cm long, also terete. *Stem* erect, flexed at base of spike, and sometimes also above sheath of cauline leaf, usually simple, rarely with 1 branch and rarely with a membranous stem bract. *Spike* (1–)3–8(–13)-flowered; *bracts* 5–8 mm long, pale green to brown below, white and membranous above, curving outwards in the upper half, the inner 4–6 mm long, shorter than the outer. *Flowers* stellate, white or cream to pale yellow, outer tepals often reddish or brown on the reverse; *perianth tube* 2–3 mm long, infundibuliform; *tepals* (6–)8–12(–14) mm long, ovate, 3–5.5 mm wide. *Filaments* 2–3(–5) mm long; *anthers* 2–3(–4) mm long. Ovary ca. 2 mm long, *style* 6–12 mm long, dividing above the apex of the anthers, branches 1–2.5 mm long. *Capsule*

globose, 3–4.5 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 4700).

Flowering time. August to October (to November at high altitudes).

Distribution. Mountains and wet sandy flats from the Caledon district and Cape Peninsula north to Piketberg and the Cedarberg at Pakhuis Pass. Figure 43.

Geissorhiza juncea is a fairly common southwestern Cape species, most often encountered on sandy flats or slopes and occasionally also on damper clay or granite soil. It often grows in semi-marshy situations, or places extremely wet during the rainy winter and spring. The flowers are usually cream-colored with a red flush on the reverse of the outer tepals, but flowers may be nearly white, or yellowish and with or without a reddish flush on the reverse. The small flowers are in no way distinctive, and *G. juncea* is most readily recognized by its tall, slender habit with two, terete, basal, narrowly four-grooved leaves and third shorter, partly sheathing leaf inserted high up on the stem.

It has been confused at times with the unrelated, but superficially similar *Geissorhiza scillaris*, especially by Foster (1941), and specimens he cites as *G. juncea* var. *pallidiflora*, but not the type, are mainly referable to this species. *Geissorhiza scillaris* has nearly identical small, short-tubed, white or sometimes blue flowers but a single basal, subterete leaf; a second, almost entirely sheathing, either basal or cauline leaf; and a characteristic small, sheathing membranous stem bract below the spike. It can be distinguished on all of these characters from *G. juncea*. These two species are actually only distantly related, *G. juncea* having concentric and *G. scillaris* imbricate corm tunics (Goldblatt, 1983). *Geissorhiza juncea* is allied to a group of species including *G. humilis* and *G. hispidula* (section *Angustifolia*) which have small corms with hard concentric tunics and narrow leaves with raised and thickened margins and midribs and it can be readily distinguished from these species by its terete leaves. It is closely allied to *G. furva* a low growing species with moderate to large deep yellow flowers and similar narrow, terete leaves.

While *Geissorhiza juncea* typically has small, white- to pale yellow-colored flowers on slender spikes of six to ten blooms over most of its range, several collections comprise somewhat shorter plants with fewer and larger yellow flowers with

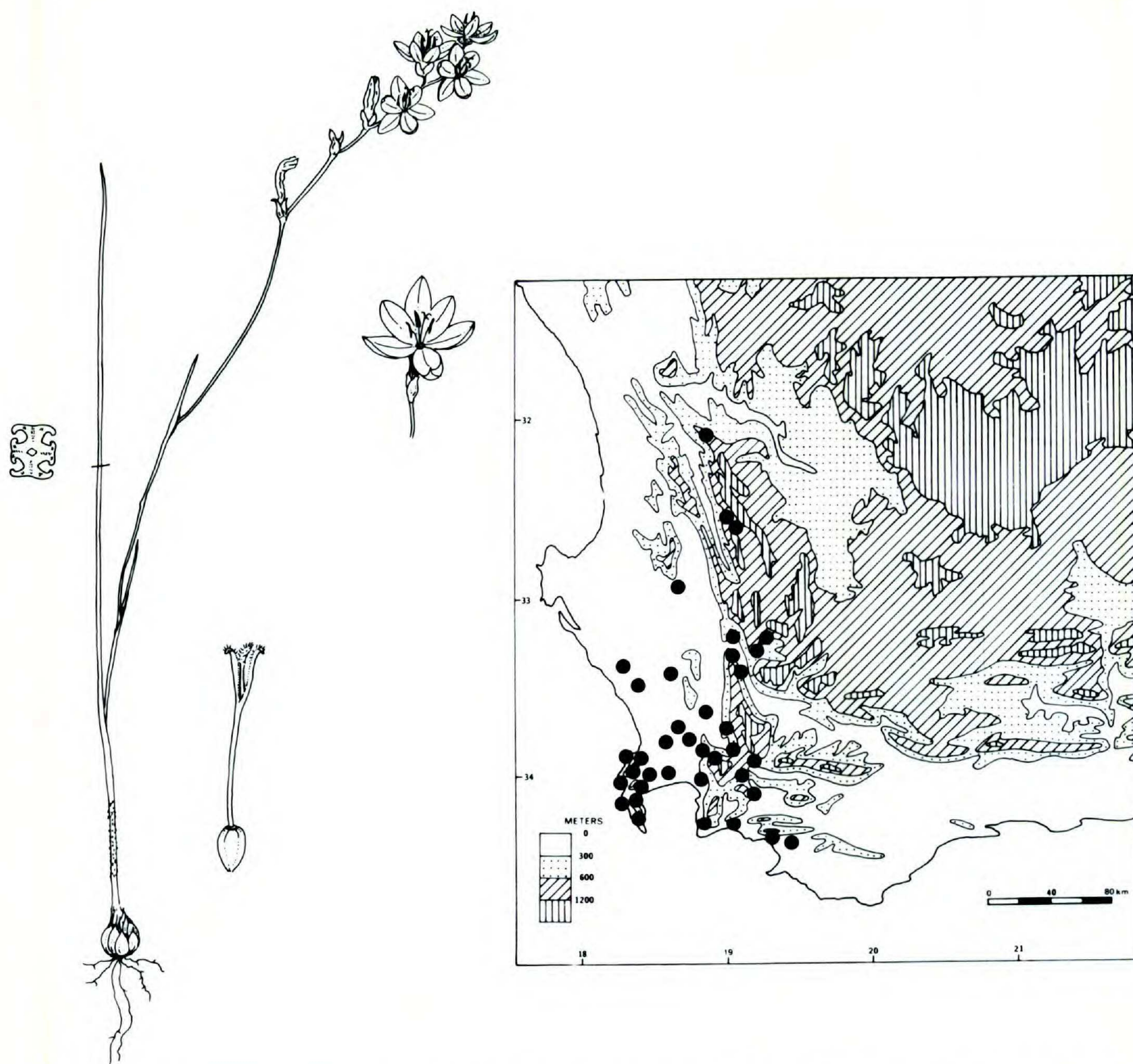


FIGURE 43. Morphology and distribution of *Geissorhiza juncea*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6283A, Malmesbury Commonage).

tepals in the 12–14 mm range (Walgate 381, Acocks 24412, Lewis & Davis 2231, Goldblatt 6283A). These collections seem mainly to have come from areas of clay soils and they may be an ecotype adapted to this substrate. They intergrade with typical *G. juncea* and are not sufficiently distinct to merit taxonomic recognition. However, this larger flowered form approaches the related *G. furva* in many ways. *Geissorhiza furva* has deep yellow flowers with tepals 15–22 (–28) mm long on spikes of one to three blooms, and the plants are typically shorter than *G. juncea* being only 5–12 (–18) cm high. The flowers of *G. furva* are distinctive when dry as they turn an unusual blackish color with age.

The taxonomy and nomenclature of *Geisso-*

rhiza juncea have been much confused at times. The species was not distinguished from the superficially similar *G. scillaris* (the type sheet of which includes specimens of both species) by Thunberg and several subsequent authors (Goldblatt, 1983). Only in 1821 was this common Cape plant described and recognized as a distinct species. Ecklon (1827) clearly regarded the species as distinct but applied to it the name *G. setifolia*, a nomen nudum, nevertheless taken up by several authorities. Baker (1878) initially regarded *G. juncea* as a separate species but he also recognized as a new species, *G. filifolia* (of which I have only seen a photograph purporting to be the type) as well as *G. secunda* var. *setifolia*, both of which seem to differ in no significant way from

typical *G. juncea*. Later, Baker (1892, 1896) treated *G. juncea* as a variety of *G. humilis* while continuing to recognize both *G. filifolia* and *G. secunda* var. *setifolia*. Foster clarified the situation considerably, but he also failed to realize that *G. juncea* and *G. scillaris* were separate species, although he attempted to distinguish them at the varietal level.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) hills near Berg River, Piketberg (DC), *Schlechter* 5273 (B, BM, BOL, E, PRE, S, Z).

3319 (Wuppertal) Pakhuis Pass (AA), *Leipoldt* s.n. (STE); upper S-facing slopes of Pakhuis Pass, *Goldblatt* 6398 (MO, NBG, S); Elands Kloof (CA), *Lewis* s.n. (BOL 31885), *Barker* 3117 (NBG); Elands Kloof, marshy area, *Thompson* 1542 (MO, PRE, STE); flats near entrance to Elands Kloof, *Esterhuysen* 13013 (BOL).

3318 (Cape Town) Kapok Berg, Darling (AC), *H. Bolus* 12841 (BOL); summit of Contreberg, *Pillans* 6906 (BOL); Mamre hills, *Barker* 1765 (NBG); stony outcrops near Darling, *Lewis* 891 (SAM), Groene Kloof, *Zeyher* 294 (SAM); Malmesbury commonage (BC), *Lewis* 3630 (SAM), *Goldblatt* 6283A (MO, PRE); between Malmesbury and Mooresburg, *L. Bolus* s.n. (BOL 20647, K); Devils Peak (CD), *Wolley Dod* 3011 (BOL), 520 (BM, K); Table Mt., Disa Gorge, *Esterhuysen* 17574 (BOL); Table Mt., *Ecklon* 316 (MO, PRE, S), *H. Bolus* 4615 (BOL, BR, GH, Z); W slopes of Lions Head, *Wolley Dod* 2838 (BOL, K); slopes of Lions Head, above Round House, *Goldblatt* 4700 (MO); Lions Head, *Wilms* 3702 (B, L, PH); Platteklip Gorge, Table Mt., *Galpin* 4689 (K, PRE); Table Mt., plateau, *Werdermann & Oberdieck* 763 (B), *Goldblatt* 5309 (MO), 5310 (MO); Table Mt., Llandudno Ravine, *Esterhuysen* 35678 (C, E, M, MO, NU, PRE, WAG, US); Kenilworth Race Course, *Lewis* 627 (SAM); 6.4 km WNW of Windmill (DB), *Acocks* 24412 (MO, PRE); between Paarl and Pont, *Drège* 8460 (K); Durbanville (DC), *Compton* 16017 (NBG); Hercules Pillar (DD), *Barker* 1768 (NBG); Bottelary road near Stellenbosch, *Lewis & Davis* 2231 (SAM); Stellenbosch, *Duthie* 586 (BOL); Jonkershoek, upper slopes of Ridge Peak, *Esterhuysen* 32744A (BOL); Jonkershoek, valley below The Twins, *Esterhuysen* 34387 (BOL); Jonkershoek, *Taylor* 5975 (STE), 5198 (PRE, STE).

3319 (Worcester) Mts. near Tulbagh Falls (AC), *H. Bolus* 5388 (BOL, K); Tulbagh, *Pappe* s.n. (SAM 48576); valley above Tulbagh falls, *Esterhuysen* 35064 (MO, PRE, US); sandy flats between Ceres Road (Wolseley) and Bains Kloof, *Schlechter* 9088 (B, BM, BOL); Mts. above Ceres (AD), *Bayliss* 6162 (MO); Prince Alfreds Hamlet, *Walgate* 381 (NBG, SAM); Darling Bridge, *Lewis* 4791 (PRE, SAM); between Worcester and Villiersdorp (CB-CC), *Barker* 7538 (BOL, NBG, W); French Hoek (CC), *Phillips* 1310 (SAM), *Barker* 4176 (NBG); between French Hoek and Villiersdorp, *Lewis* 2897 (SAM); Olifants Berg, *Gillett* 1858 (BOL, STE); Drakenstein Mts., 2,000–3,000 ft., *Drège* s.n. (B, G, S).

3418 (Simonstown) Steenberg Plateau, *Lewis* s.n. (SAM 56866); Muizenberg, *Prior* s.n. (PRE); Orange Kloof, *L. Bolus* s.n. (BOL); Karbonkelberg, Hout Bay, *Stokoe* s.n. (SAM 60196); Kalk Bay Mt., *Barker* 4223

(NBG); Noordhoek Mt., beside stream, *Barker* 2353 (NBG); Skoorsteen Kop, Hout Bay, *Acocks* 683 (PRE); Smiths Farm (AC), *Lewis* 669 (SAM); Cirkels Vlei, Cape Point Reserve, *Compton* 16333 (NBG); between Klaasjagers and Smitswinkel, *Wolley Dod* 1508 (BM); Cape Point Reserve, veld near W Coast, *Goldblatt* 422 (BOL); Cape Flats (BA), *Pappe* s.n. (SAM 48575), *Zeyher* 3963 (B, SAM), *Rehmann* 1850 (BM, Z); Somerset West (BB), *Zeyher* s.n. (SAM); rocky S slopes of Helderberg, *Esterhuysen* 14661 (BOL, PRE); Sir Lowrys Pass Station, *Guthrie* 2532 (NBG); between Rooi Els and Manganese mine (BD), *Boucher* 1659 (STE); Palmietrivier, *Penther* 605 (Z).

3419 (Caledon) 4 mi. N of Bot Rivier (AA), *Goldblatt* 294 (BOL); flats E of Viljoens Pass, *Davis* s.n. (SAM 61721); Vogelklip, Hermanus (AD), *Barker* 1790 (NBG); mt. slopes behind Voelklip, Hermanus, *Goldblatt* 7040A (MO); 2 mi. from Stanford near head of vlei, *Gillett* 4450 (BOL, MO); Riviersonderend Mts. (B), *Stokoe* s.n. (SAM 63479).

WITHOUT PRECISE LOCALITY: between Malmesbury and Hopefield, *Salter* s.n. (BOL); Zwartland, *Bachmann* 1090 (B); Cape of Good Hope (CBS), *Mund & Maire* 506, (B), 508 (B), *Niven* s.n. (BR), *Berguis* s.n. (B), *Link* 1205 (B), *Lichtenstein* 508 (B), *Siebold* 573 (B), *Thunberg* s.n. (*Ixia flexuosa*) (S); Worcester, Tulbaghs-kloof, Tulbaghsthal, Witsenberg, und bei Vogelvalei, *Ecklon & Zeyher Irid.* 217 (77) (B, BM "Tulbagh").

- 34. *Geissorhiza furva* Ker ex Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 70. 1896; Foster, Contr. Gray Herb. 135: 26–27. 1941. TYPE: South Africa. Cape: between Paarl and Pont, *Drège* 8478 (lectotype, K, here designated; isoelectotypes, G, L); *Masson* s.n. (syntypes, BM, K); *H. Bolus* 4341 (syntype, not seen, location uncertain). FIGURE 44.**

Geissorhiza furva Banks ex Ker, Ann. Bot. (König & Sims) 1: 224. 1804, nom. nud. (the Banks specimen annotated "*Ixia furva*" on which this name is based is at BM, was collected by Masson, and probably represents authentic material).

Plants small to medium, 7–18 cm high. *Corm* globose, more or less symmetric, but obliquely flattened below, 7–9 mm diam., tunics light brown, concentric, the layers fragmenting irregularly, drawn into bristles above. *Cataphyll* membranous, sticky and with sand adhering. *Leaves* 3 (rarely 2), evidently terete, narrowly 4-grooved, the lower two basal, the lowermost longest, usually slightly exceeding the stem, the second sheathing below, the uppermost cauline, sheathing the stem below, terete above, sometimes becoming short and bract-like. *Stem* erect, flexed above the leaf sheaths, and below the first flower. *Spike* 1–3-flowered, flexuose; *bracts* 6–12 mm long, herbaceous below, dry and papery above, the inner usually slightly smaller than the

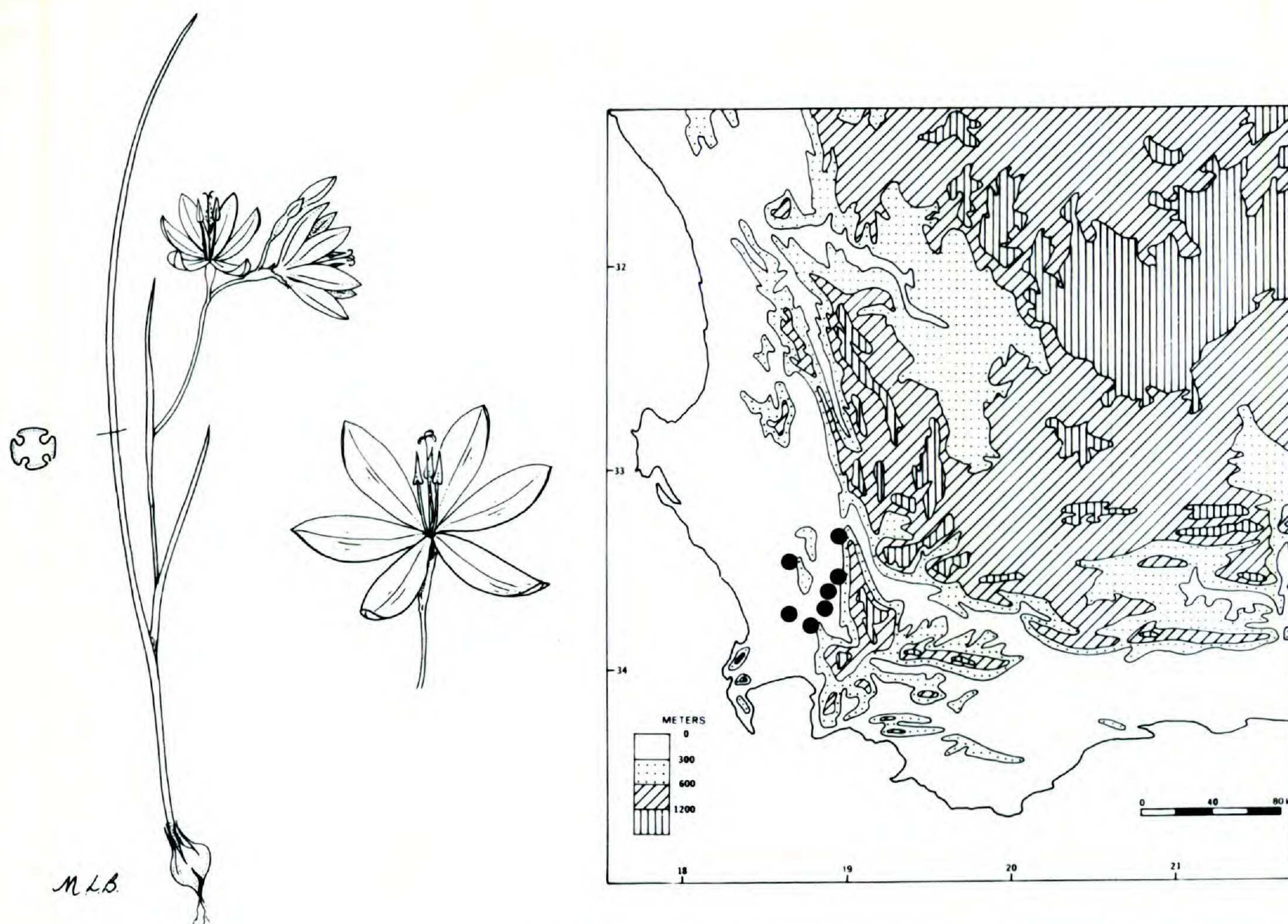


FIGURE 44. Morphology and distribution of *Geissorhiza furva*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6212, foot of the Elandsbloof Mts.).

outer, sometimes longer. *Flower* stellate, tepals spreading, deep golden yellow, becoming blackish when dry; *perianth tube* infundibuliform, (3–)4–5 mm long; *tepals* 15–22(–28) mm long, obovate, to 12 mm wide. *Filaments* 7–13 mm long, erect; *anthers* to 6 mm long, yellow. *Ovary* 2–4 mm long, *style* dividing near the apex of the anthers, branches to 5 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to mid-October.

Distribution. Southwestern Cape, stony or sandy situations along the foot of the mountains between Stellenbosch and Gouda. Figure 44.

Geissorhiza furva is closely related to the widespread, small-flowered *G. juncea*, with which it is almost identical in vegetative morphology. It has three terete leaves, the lower two more or less basal and the upper cauline and partly sheathing; an unbranched stem; and small corms with hard, concentric tunics. It is however distinctive in having a 1–3-flowered spike and large, deep yellow flowers, which when dry turn a very characteristic blackish color. *Geissorhiza furva* is

apparently restricted to the Paarl and Wellington districts of the southwestern Cape, where it occurs on stony or sandy sites at the foot of the mountains that run north–south, parallel to the west coast. It is known from only a few sites and is now seriously endangered by agricultural expansion in the area where it occurs.

It varies considerably in height and flower size. Specimens collected by Compton (11732) and Leighton (2002) are 6–9 cm high with flowers having tepals about 16 mm long, while plants from the same general area (Barker 403), as well as collections from other localities are to 20 cm high, with tepals over 25 mm long. This variation may be seasonal but is just as likely to be genetic.

Three collections were cited by Baker (1892) in the protologue, Drège 8478, Masson s.n., and H. Bolus 4341. Of these, Foster designated the Drège specimen at the Kew Herbarium the “type” and a duplicate at Geneva the “isotype.” Following my practice in this revision, the Kew specimen is accepted as effectively lectotypified by Foster. Baker believed that the flowers were bright red-purple, but the type material I have

examined has the dull blackish flowers typical of several dry collections, which are known to have been deep yellow when live.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town), near Malmesbury (BC), *Schlechter* 1652 (B, BR, K), *H. Bolus* 4339 (K); near Wellington (DB), *Compton* 11732 (NBG), *Barker* 403 (NBG, STE); between Paarl and Pont, *Drège* 8478 (G, K, L); Hercules Pillar (DD), *Compton* 16014 (BOL, NBG); Mulders Vlei, damp sandy ground, *Lewis* 4448 (SAM); N base of Joostenberg, on reddish sand, *Pillans* 9262 (BOL, K); flats N of Hercules Pillar in moist places, *Leighton* 555 (BOL, K); flats N of Paarl, *Leighton* 2002 (BOL); flats at N end of Paarl, *Esterhuysen* 6127 (BOL).

3319 (Worcester) foot of the Elandskloof Mts., near entrance to Elandsberg farm, stony ground (AC), *Goldblatt* 6212 (MO); Wellington, foot of Groenberg in renosterveld (CA), *Marloth* 11661 (PRE).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, *Ecklon & Zeyher* *Irid.* 217 (K), *Masson s.n.* (BM, K).

35. *Geissorhiza stenosphon* Goldbl., sp. nov.

TYPE: South Africa. Cape: Cold Bokkeveld Mts., Hexberg, SE slopes at ca. 4,000 ft., *Viviers* 1300 (holotype, STE; isotypes, JF, K, MO, NBG, S, WAG).

Planta 10–30 cm alta, tunicis cormi concentricis pallide brunneis, foliis 3, teretis, caule erecto vel inclinato, spica 1–2 florum, bracteis 15–20 mm longis, floribus hypocrateriformibus albis, reverso carneis, tubo perianthii 40–50 mm longo, filamentis 2 mm longis, antheris 2–3 mm longis, ramis styli inter apicis tubi et basi antherarum divergentibus.

Plants slender, 10–30 cm high excluding the flowers. *Corm* globose, 9–12 mm diam., tunics light brown, concentric to more or less imbricate (? by distortion) with regular notches below, brittle-membranous to slightly woody, drawn into bristles above. *Cataphylls* usually 2, membranous, flushed purple above, the upper reaching above the ground. *Leaves* 3, the lower two basal, terete with 4 narrow longitudinal grooves, erect, reaching to about the middle of the spike, the third inserted above the ground and sheathing the stem below, also terete. *Stem* erect to inclined, unbranched, bearing an entirely sheathing, herbaceous stem bract in the upper half, this 15–22 mm long. *Spike* 1–2-flowered; *bracts* 15–20 mm long, the outer pale green with the upper margins membranous to dry, the inner entirely membranous, half to two-thirds as long as the outer. *Flowers* hypocrateriform, white, the tube and reverse of the tepals pale pink, occasionally purple, becoming darker on fading; *perianth tube* 40–50 mm long, cylindric throughout; *tepals* 12–14 mm long, lanceolate, ca. 4 mm wide, the inner somewhat larger but shorter than the outer. *Fil-*

aments 2 mm long; *anthers* 2–3 mm long. *Ovary* 2–3 mm long, *style* reaching at least to the apex of the perianth tube, or to the top of the filaments, branches 2–2.5 mm long, ascending but becoming gently recurved ultimately. *Capsule* oval, ca. 10 mm long. *Chromosome number*, unknown.

Flowering time. December.

Distribution. Apparently restricted to the upper slopes of Hexberg in the Cold Bokkeveld Mountains.

Geissorhiza stenosphon is included here in *Geissorhiza* with some hesitation as it has a number of features that do not conform to the normal condition for the genus. The style in the several specimens known divides between the mouth of the perianth tube and the apex of the filaments and the branches themselves are relatively long. This is reminiscent of the related genus *Hesperantha* in which the style divides either at the apex of the tube or occasionally within the tube. However, the style branches of *Hesperantha* are always very long and when exerted from the tube, as is usual, always spread horizontally (Goldblatt, 1984). The fact that the style sometimes divides well above the mouth of the tube is completely inconsistent with *Hesperantha* but does have a parallel in *Geissorhiza*, where the unrelated species, *G. spiralis* and *G. torta*, have a style that divides near the base of the anthers. Also, in two species of *Geissorhiza*, the style and style branches are entirely included in the perianth tube. Thus *G. stenosphon* is not entirely discordant with *Geissorhiza*. Other features of *G. stenosphon* such as the terete, four-grooved leaves, flower open during the day and the apparently extrorse anthers accord well with *Geissorhiza* and not at all with *Hesperantha*. The majority of species of the latter, including almost all white-flowered species open only in the late afternoon or evening. Moreover, the anthers in *Hesperantha* are introrse at anthesis and terete four-grooved leaves are not known in the genus.

The affinities of *Geissorhiza stenosphon* within the genus are uncertain. The remarkably long and slender perianth tube as well as the unusual style that divides at or below the base of the anthers set the species well apart. Similar long tubes occur only in section *Engysiphon* but species of this section are otherwise very different, being more robust, and having declinate zygomorphic flowers, long floral bracts and distinctive long capsules. I assign *G. stenosphon* tentatively to subgenus *Weihea* and to section *Angustifolia*. The

terete leaf and the apically membranous to dry bracts accord well with *G. juncea* of this section. The long perianth tube is the only character discordant with the section apart from the peculiar style that divides between the mouth of the tube and the base of the anthers. It seems reasonable to regard the long tube as a relatively recently evolved feature directly adapted to a specific pollinator.

The species was discovered only three years ago in 1982 by Elsie Esterhuysen who found a few plants at the end of the flowering season. The following year repeated visits to the Hexberg, its only known site, by Mike Viviers, Forestry Officer at Cedarberg Forest Station, resulted in the discovery of extensive populations above 1,500 m. *Geissorhiza stenosphon* is apparently restricted to the south and east slopes of Hexberg alone where it blooms in early summer on damp south to east trending slopes at altitudes above 1,500 m.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cold Bokkeveld, near Elands Kloof, Hexberg slopes at ca. 4,000 ft. (CA), Esterhuysen 35847 (MO); Hexberg, 1,500 m, E-W trending kloofs on S-facing slopes, in peaty soils Viviers 1300 (JF, K, MO, NBG, S, STE, WAG).

SECTION IXIOPSIS

6. Section *Ixiopsis* Goldbl., sect. nov. TYPE: *G. hesperanthoides* Schltr.

Geissorhiza subgenus *Ixiopsis* Foster, Contr. Gray Herb. 135: 70. 1941, pro parte but excluding the type species, now *Gladiolus bojeri* (Baker) Goldbl.

Tunicae cormi molles membranaceae vel fibrosae reticulatae, foliis 2–3 linearibus marginibus costisque incrassatis, bracteis herbaceis vel membranaceis, supra saepe siccis, floribus actinomorpha, stellatis vel hypocrateriformibus, tubo brevi vel ad apicem bractearum extenso.

Corm tunics soft and membranous to fibrous and reticulate, *leaves* 3, the upper one or two sometimes bract-like and sheathing, the margins and midrib heavily thickened, linear, *bracts* herbaceous to membranous becoming dry above, *flowers* stellate to hypocrateriform, actinomorphic, the tube either short, or reaching to the apex of, or well-exserted from the bracts, *stamens* equal.

Species. 5.

36. *Geissorhiza umbrosa* Lewis, J. S. African Bot. 7: 46–47. 1941. TYPE: South Africa. Cape: wet rocks on Table Mt., Lewis 662 (lecto-

type, SAM 54288, here designated; isolecotypes, BOL, PRE). FIGURE 45.

Plants 12–30 cm high. *Corm* globose, 3.5–6 mm diam., the remains of older corms sometimes persisting below, tunics either membranous to soft papery and usually accumulating very little, or composed of medium to fine reticulate fibers. *Cataphyll* membranous, often brownish. *Leaves* 3, linear (to subterete), erect to falcate, 1–2 mm wide, one-third to as long as the stem, oblong in section, margins and midrib thickened and 2-grooved on each surface, the lower two basal, the second leaf shorter and sheathing the lower part of stem for a short distance (occasionally with no free apex), the uppermost leaf inserted on the lower third of the stem, sheathing for at least two-thirds to almost entirely. *Stem* erect or inclined, smooth, simple, or rarely 1-branched. *Spike* 2–4(–10)-flowered, lax; *bracts* 6–8(–10) mm long, green, or becoming dry in upper half at flowering time. *Flower* stellate, white, the reverse of the outer tepals often pink or reddish especially on fading; *perianth tube* 2.5–4 mm long; *tepals* 10–13 mm long, 5–7 mm wide, obovate. *Filaments* 4–5 mm long; *anthers* 3–4 mm long, pale yellow. *Ovary* 2–3 mm long; *style* branching near the apex of the anthers, branches ca. 1.5 mm long, recurved. *Capsule* globose, 5–6 mm long. *Chromosome number*, unknown.

Flowering time. Late October to December.

Distribution. Sheltered, damp sites in the mountains of the southwestern Cape from the Peninsula east to the Riviersonderend Mountains and north to the Cedarberg. Figure 45.

Geissorhiza umbrosa appears to be related to the fairly widespread montane and lowland *G. juncea* (section *Angustifolia*) on the one hand and to *G. hesperanthoides* and *G. alticola* (section *Ixiopsis*) on the other and it seems to be a link between these two sections. It is particularly difficult to distinguish *G. umbrosa* both vegetatively and in flower from *G. juncea*, but it is distinct in its corm which has tunics of soft, but rather irregularly broken membranous to fibrous layers. This contrasts sharply with the corm of *G. juncea* which has hard concentric layers forming bristles above. *Geissorhiza umbrosa* also has flattened rather than completely terete 4-grooved leaves that are found in *G. juncea*. In *G. umbrosa*, the leaves are slightly oblong in section, with prominently thickened midrib and margins and deep grooves between.

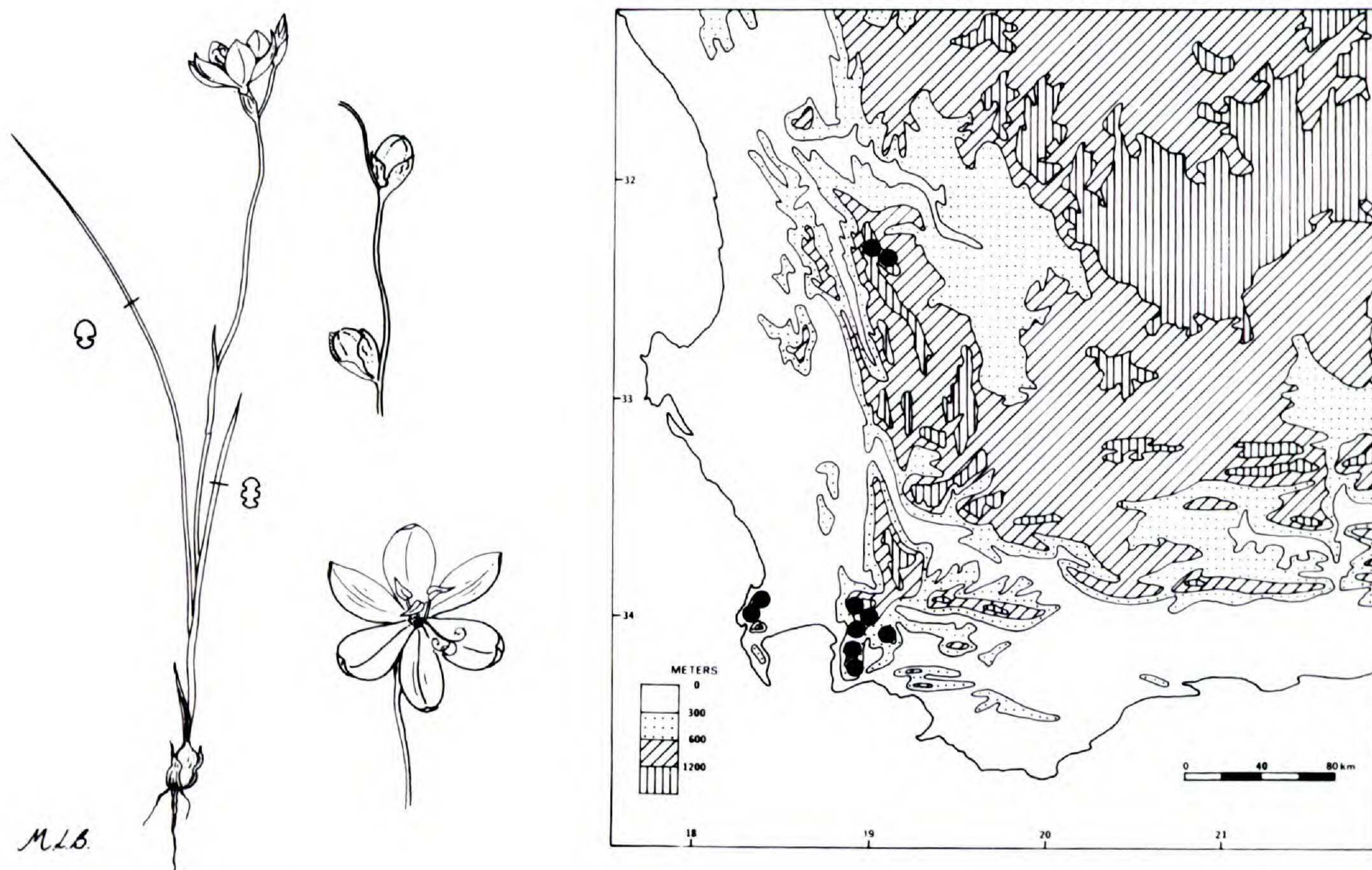


FIGURE 45. Morphology and distribution of *Geissorhiza umbrosa*. Habit $\times 0.5$; flower and fruiting stalk life size; leaf section enlarged (Goldblatt 6727, Table Mt.).

Confusion of *Geissorhiza umbrosa* with *G. similis* is frequent in the absence of corms. Both species have relatively small white flowers, unbranched stems and slender leaves with thickened margins and midribs. The corm tunics of *G. similis* are hard and woody to firm-papery and distinctly imbricate. In plants that lack corms, the flowers must be measured carefully. *Geissorhiza similis* has smaller flowers with tepals 9–12 mm long, a tube 2.5–3 mm long, not exceeding the bracts and shorter filaments and anthers than those of *G. umbrosa*. Despite that close similarity of the above ground parts of the two species, they are probably only distantly related and are here placed in different subgenera.

The circumscription of *Geissorhiza umbrosa* is expanded here to include a form from the mountains east of the Cape Flats, which has corm tunics composed of medium to fine reticulate fibers and persistent older corms. Plants with fibrous corm tunics rather than the typical papery to membranous tunics, differ in no other way from typical *G. umbrosa* and cannot reasonably be regarded as belonging to separate species. A tendency for the tunics to become fibrous can be seen in some collections of the type form from the Cape Peninsula (*H. Bolus* 4985), supporting

my view that forms with fibrous or membranous tunics are conspecific.

The soft tunics of *Geissorhiza umbrosa* can perhaps be correlated with its moist habitat. Species in several genera of Iridaceae which typically have hard and even woody tunics exhibit a similar tendency to have softer corm tunics in moister habitats. *Geissorhiza umbrosa* grows in cracks in cliffs, in moss on south-facing slopes or in marshes at high elevations where summer moisture is available from the prevailing south-east winds which water the higher mountains of the southwestern Cape. In these sheltered places plants flower late in the season, in November and December in the south but in the drier north, in October and November. In open or marshy places *G. umbrosa* flowers only after fires but in rocky sites it may bloom annually unless completely overgrown by surrounding vegetation.

Two collections from the Cedarberg, *Esterhuysen* 35669A and *Goldblatt* 5140, match the Table Mountain form reasonably well and are assigned to *Geissorhiza umbrosa*. Another Cedarberg collection, *Esterhuysen* 35669 from the same locality as 35669A, has broken brittle tunics and smaller flowers and corresponds closely to *G. similis*. The Cedarberg–southwestern Cape

break in distribution is unusual and may reflect lack of collecting in the area between rather than a true disjunction. *Geissorhiza umbrosa* is inconspicuous and few flowered and it may well have been overlooked in the intervening mountains.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cedarberg, Middelberg vlakte (AC), *Goldblatt 5140* (MO, NBG, PRE); South Cedarberg, path from base of Sneeu Berg to the Maltese Cross, in marshy area after fire (CA), *Esterhuysen 35669A* (MO).

3318 (Cape Town) Table Mt., lower plateau (CD), *Lewis 960* (K, SAM 56481), *Goldblatt 6727* (MO, PRE); Table Mt., rock crevices in cliffs above Stinkwater, 3,000 ft., *H. Bolus 4985* (BOL); wet rocks, Table Mt., *Lewis 662* (BOL, SAM); in summo Monte tabulari, *Pappe s.n.* (SAM); summit, Table Mt., *Scott Elliot 113* (E), *Dümmer 182* (E); Echo Valley, Table Mt., *Compton 8305* (NBG); Table Mt., W slopes, 2,000 ft., *Esterhuysen 8217* (BOL); between rocks at summit of Table Mt., *Ecklon 315* (BM, G, M, MO, Z); Table Mt., lower plateau on mossy cliff in running water, *Goldblatt 5306* (MO, NBG, PRE, S); Table Mt. between Skeleton and Window Gorges, *Goldblatt 6227* (MO, PRE); Table Mt., ca. 3,200 ft., top of gully, *Esterhuysen 35386* (BOL, K, MO, US); "Waai Vley," wet rocks, *Wolley Dod 2146* (in part) (K); summit of Table Mt., *H. Bolus 4615* (BM, BOL, K); damp rocks in a kloof over Orange Kloof farm, ca. 1,200 ft., *Wolley Dod 3365* (BOL); Table Mt., 2,500 ft., *Schlechter 130* (B, FI, G, K, P, W, Z); Devils Peak, S side of summit, *Esterhuysen 35712* (MO); on precipices, Swartboskloof, Jonkershoek (DD), *Borchardt 551* (BOL).

3418 (Simonstown) Hottentots Holland, Moordenaars Kop (BB), *Stokoe s.n.* (SAM); between Somerset Sneeu kop and Landrostkop, *Stokoe s.n.* (SAM 55104); Somerset Sneeu kop, rock ledges, ca. 5,000 ft., *Esterhuysen 2934* (BOL), 8235 (BOL); Kogelberg, *Stokoe s.n.* (SAM 56413); NE side of Platboskop, Kogelberg Forest Reserve (BD), *Boucher 430* (STE); Platberg, *Boucher 189* (STE).

3419 (Caledon) Lebanon Forest Reserve, Jakkals River catchment Ia (AA), *Haynes 438* (STE); Schilpadkop area, Riviersonderand Mts. (BA), *Esterhuysen 21051* (BOL).

37. *Geissorhiza alticola* Goldbl., sp. nov. TYPE: South Africa. Cape: Louwshoek Peak, above Kaaimansgat, Villiersdorp, *Esterhuysen 35626* (holotype, MO; isotypes, BOL, K, NBG, PRE, S, WAG). FIGURE 46.

Planta 20–30 cm alta, tunicis cormi papyraceis, foliis (2–)3, inferiore basali quadrisulcato, superioribus caulem vaginantibus, caule erecto, spica 3–5 florum, floribus stellatis caeruleo-violaceis, tubo 2–3 mm longo, tepalis 11–13 mm longis, antheris 4 mm longis, capsula globosa 5–6 mm longa.

Plants 20–30 cm high. *Corm* globose, symmetric 7–10 mm diam., tunics papery, light brown, notched or torn below, the layers not

accumulating. *Leaves* (2–)3, linear, 2–3 mm wide, with 2 narrow grooves on each surface, and margins and midrib much thickened, the lowermost basal, the second inserted near ground level and sheathing the lower part of the stem, apex free for a short distance, the upper leaf inserted in the mid part of the stem and sheathing almost entirely but with a short free apex. *Stem* erect, straight, unbranched. *Spike* flexuose, 3–5-flowered; *bracts* 7–10 mm long, herbaceous below, dry and membranous above. *Flowers* stellate, blue-violet; *perianth tube* short, 2–3 mm long, infundibuliform; *tepals* 11–13 mm long, obovate, ca. 5 mm wide. *Filaments* 4–5 mm long; *anthers* 4 mm long, yellow. *Ovary* 2–3 mm long, style dividing near the apex of the anthers, becoming declinate, branches recurved. *Capsule* globose, 5–6 mm long. *Chromosome number*, unknown.

Flowering time. December to early February.

Distribution. High altitudes, 5,000–6,000 ft. in the Du Toits Kloof-Wemmershoek-Stettynskloof Mountain complex of the southwestern Cape. Figure 46.

Geissorhiza alticola is a high altitude endemic of the southwestern Cape mountains. It has been collected on only a few occasions, always by Elsie Esterhuysen, whose exploration of the mountain flora of Southern Africa is without parallel. The species appears to be allied to the *G. hesperanthoides* complex (including as well *G. nubigena* and *G. umbrosa*), and it is similar to these species in general appearance and leaf morphology but it has unbroken, papery rather than fibrous corm tunics. It can be distinguished from other high mountain species by its very short infundibuliform perianth tube, 2–3 mm long and fairly large blue-violet flower. Normally only the lowermost leaf is produced to any extent while the two upper leaves sheath the stem for most or all of their length.

Geissorhiza alticola is evidently confined to the Du Toits Kloof-Wemmershoek-Stettynskloof Mountain complex between Worcester and Paarl. It occurs only on the higher peaks, above 5,000 ft., and blooms in mid to late summer. Adequate moisture is available at this season from the prevailing southeast winds which water only the higher mountains of the southwestern Cape while the lowlands remain dry through the summer.

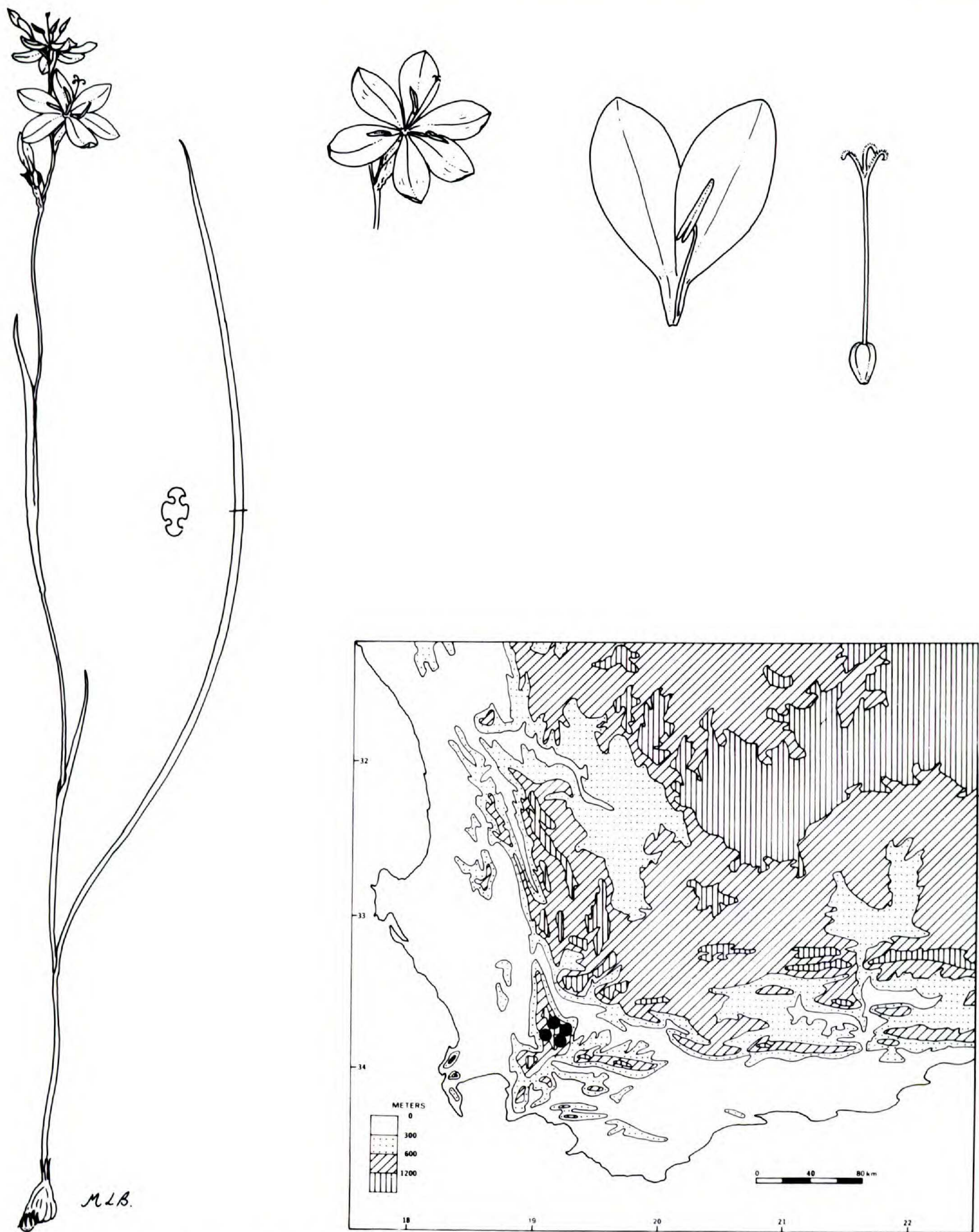


FIGURE 46. Morphology and distribution of *Geissorhiza alticola*. Habit $\times 0.5$; flower life size; partial flower and gynoecium $\times 2$; leaf section much enlarged (*Esterhuysen 35626*, Wemmershoek Peak).

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Wemmershoek Peak, below the S summit, base of rocks (CC), *Esterhuysen 36376* (BOL, MO, PRE), 35863 (E, K, MO, NBG, PRE, S, US, WAG); S slope of ridge between Goudini Sneekop and Deception Peak, 5,000 ft. (CD), *Esterhuysen 33445* (BOL, K, MO, PRE); Stettynsberg, summit amongst rocks,

5,900 ft., *Esterhuysen 11161* (BOL); Louwshoek Peak, above Kaaimansgat, Villiersdorp, *Esterhuysen 35626* (BOL, K, MO, NBG, PRE, S, WAG).

38. *Geissorhiza hesperanthoides* Schltr., Bot. Jahrb. Syst. 27: 97. 1899; Foster, Contr. Gray

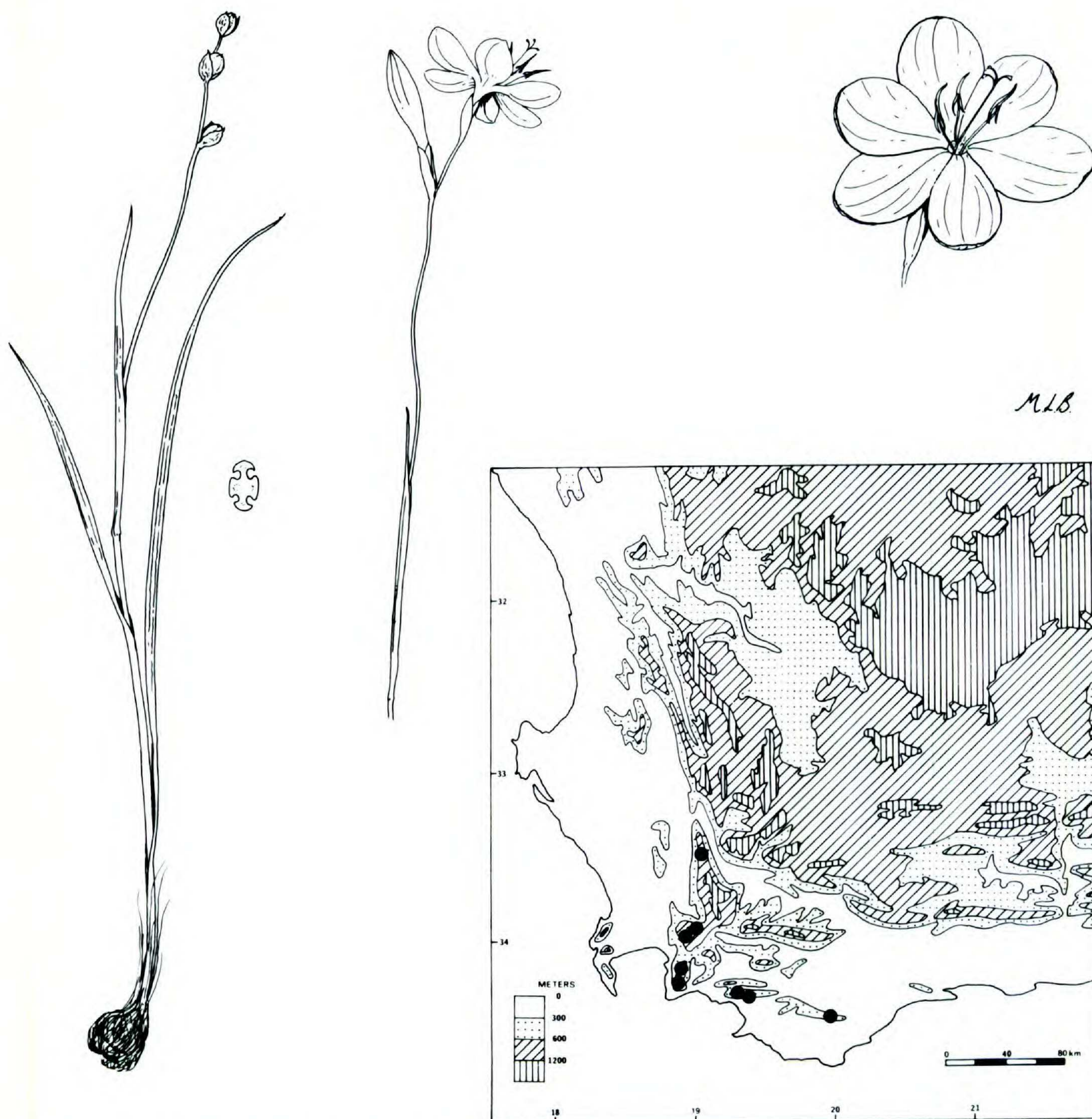


FIGURE 47. Morphology and distribution of *Geissorhiza hesperanthoides*. Habit and flowering stalk $\times 0.5$; flower life size; leaf section much enlarged (Esterhuysen 35381, Victoria Peak).

Herb. 135: 73. 1941. TYPE: South Africa. Cape: summit of mts. near Vogelgat, *Schlechter* 9555 (lectotype, B, here designated; isoelectotypes, B, BM, G, K, MO, PH, PRE, Z). FIGURE 47.

Plants 15–30 cm high. *Corm* globose, flattened below, 5–7 mm diam., tunics of fine, pale reticulate fibers, sometimes with papery, fragmented layers between, fibers extending upwards in a neck. *Cataphyll* membranous, becoming fibrous below or not evident. *Leaves* 3, rarely 2, linear, 2–3 mm wide, the margins and midrib much thickened and with 2 narrow grooves on each

surface, occasionally sticky with adhering sand, the lowermost leaf basal, longest, the second inserted near ground level and sheathing the lower part of the stem for a short distance, the uppermost inserted in the middle part of the stem and sometimes sheathing entirely or with a short free apex. *Stem* more or less erect to inclined, very rarely branched. *Spike* flexuose, 1–3-flowered; *bracts* ca. 10 mm long, herbaceous, reddish above, often with hyaline apices, the inner shorter and narrower than the outer. *Flower* stellate, tepals slightly cupped, blue to violet; *perianth tube* 5–8(–10) mm long, almost reaching the apex of the bracts at anthesis, becoming shortly exerted in

old flowers; *tepals* 12–18 mm long, oblanceolate, 6–8 mm wide. *Filaments* 7–10 mm long; *anthers* 4–5 mm long, yellow. *Ovary* 2–3 mm long, *style* exceeding the stamens, declinate, branches ca. 3 mm long, recurved. *Capsule* globose, ca. 6 mm long. *Chromosome number*, unknown.

Flowering time. Late November to December (January at highest elevations).

Distribution. Mountains of the southwestern Cape from Wellington Sneekop and Victoria Peak south to the Bredasdorp Mountains, at middle to upper altitudes usually in damp sites. Figure 47.

Geissorhiza hesperanthoides is unusual in *Geissorhiza* in having fine, fibrous corm tunics, a characteristic shared only by *G. nubigena* and *G. umbrosa*. Fibrous corm tunics are a specialized and derived character in *Geissorhiza*, where hard woody concentric tunics are most likely the primitive state, and *G. hesperanthoides* and its allies comprise a specialized group in the genus. *Geissorhiza hesperanthoides* is closely allied to *G. nubigena*, also a mountain species, which has until now been included in *G. hesperanthoides*. The two are similar in vegetative morphology but have different flowers. Those of *G. hesperanthoides* have somewhat cupped, broad, violet blue tepals and a perianth tube 5–8 mm long, extending to 7–10 mm in older flowers, typically not or barely exerted from the bracts. In *G. nubigena*, the pink flowers have narrower tepals that extend at right angles to the tube which is 10–18 mm long, well exerted at anthesis and becoming even longer in older flowers. Differences between the two species are discussed in more detail under *G. nubigena*, number 40 in this treatment.

Geissorhiza hesperanthoides occurs in Cape mountain vegetation in semi-marshy conditions at mid to upper elevations. It is not rare, but it blooms irregularly and is conspicuous only in the seasons following a fire or in cleared areas where it is not completely overgrown by the dominant shrubby vegetation. It extends from the Bains Kloof Mountains and Victoria Peak in the north, through the Hottentots Holland Mountains and Kogelberg to the Klein River and Bredasdorp Mountains. Although apparently disjunct between Kogelberg and the Klein River and Bredasdorp Mountains, it probably occurs in suitable habitats in the intervening mountains. The collections from Upper Wellington Sneekop in

the Bains Kloof Mountains seem somewhat unusual. The tunics are papery with no apparent development of fibers with age. The perianth tube in these populations is also somewhat longer than usual for *G. hesperanthoides* being in the 8–10 mm range, which is the upper limit for the species.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Jonkershoek Forest Reserve (DD), *Rycroft* 1464 (SAM).

3319 (Worcester) Upper Wellington Sneekop, steep S slopes and ledges, 5,500 ft. (CA), *Esterhuysen* 33073 (BOL, K, MO); Upper Wellington Sneekop, base of small cliffs in lower shale band, 5,000 ft., *Esterhuysen* 34501 (BOL).

3418 (Simonstown) SE slopes of Kogelberg, 3,000 ft. (BB), *Esterhuysen* 13328 (BOL, PRE); Landdrost-kop, Caledon Division, *Stokoe* 8094 (BOL).

3419 (Caledon) Victoria Peak, 3,500–4,500 ft. (AA), *Esterhuysen* 9769 (BOL); Victoria Peak, base of high cliffs, *Esterhuysen* 33111A (BOL); Victoria Peak, Jonkershoek Mts., *Esterhuysen* 35381 (MO), 35870 (E, K, MO, NBG, PRE, S, US, WAG), *Kerfoot* 6194 (NGB); Groenland Mts., Mt. Lebanon, 3,800 ft., damp moss on S slope, *Goldblatt* 6914 (MO); Vogelgat, above Hermanus (AD), *Schlechter* 9555 (B, BM, G, K, MO, PH, PRE, Z), *Goldblatt* 5397 (K, MO, NBG); Vogelgat, 1,600 ft., Vulture Stream gorge, *Goldblatt* 5346 (MO); Vogelgat, near Beaconhead stream, *Williams* 2955 (MO); mts. near Klein River Lake, *Guthrie* s.n. (BOL); summit of Aasvogelkop, Hermanus, *Jackson* s.n. (NGB 121217); top of Zoutmelkskop, Bredasdorp Mts. (DB), *Galpin* 11334 (K, PRE).

39. *Geissorhiza cataractarum* Goldbl., sp. nov.

TYPE: South Africa. Cape: above Bettys Bay, dripping S-facing cliffs in moss, *Goldblatt* 5355 (holotype, MO; isotypes, BR, E, K, NBG, NSW, PRE, S, US, WAG). FIGURE 48.

Planta 10–20(–30) cm alta, cormo elongato-globoso, 4–5 mm diam., tunicis membranaceis, evanescentibus, foliis 3, inferioribus duabus basalibus linearibus, caule decumbente, spica 1–5 floribus, bracteis herbaceis, floribus stellatis, caeruleis, tubo 4–6 mm longo, tepalis 14–20 mm longis, filamentis aequalibus ca. 10 mm longis, antheris 3(–4) mm longis.

Plants 10–20(–30) cm high, often decumbent. *Corm* elongate-globose, symmetric, 4–5 mm diam., tunics pale to light brown, firm to soft membranous, not normally accumulating. *Cataphyll* membranous, usually lacking in dry specimens. *Leaves* 3, linear, 1–1.5 mm wide, margins and midrib enlarged and 2-grooved on each surface, the lower two leaves basal, usually long, curved and trailing, the uppermost leaf inserted in the lower part of the stem, short and partly sheathing. *Stem* decumbent or suberect, unbranched. *Spike* 1–5-flowered; *bracts* herba-

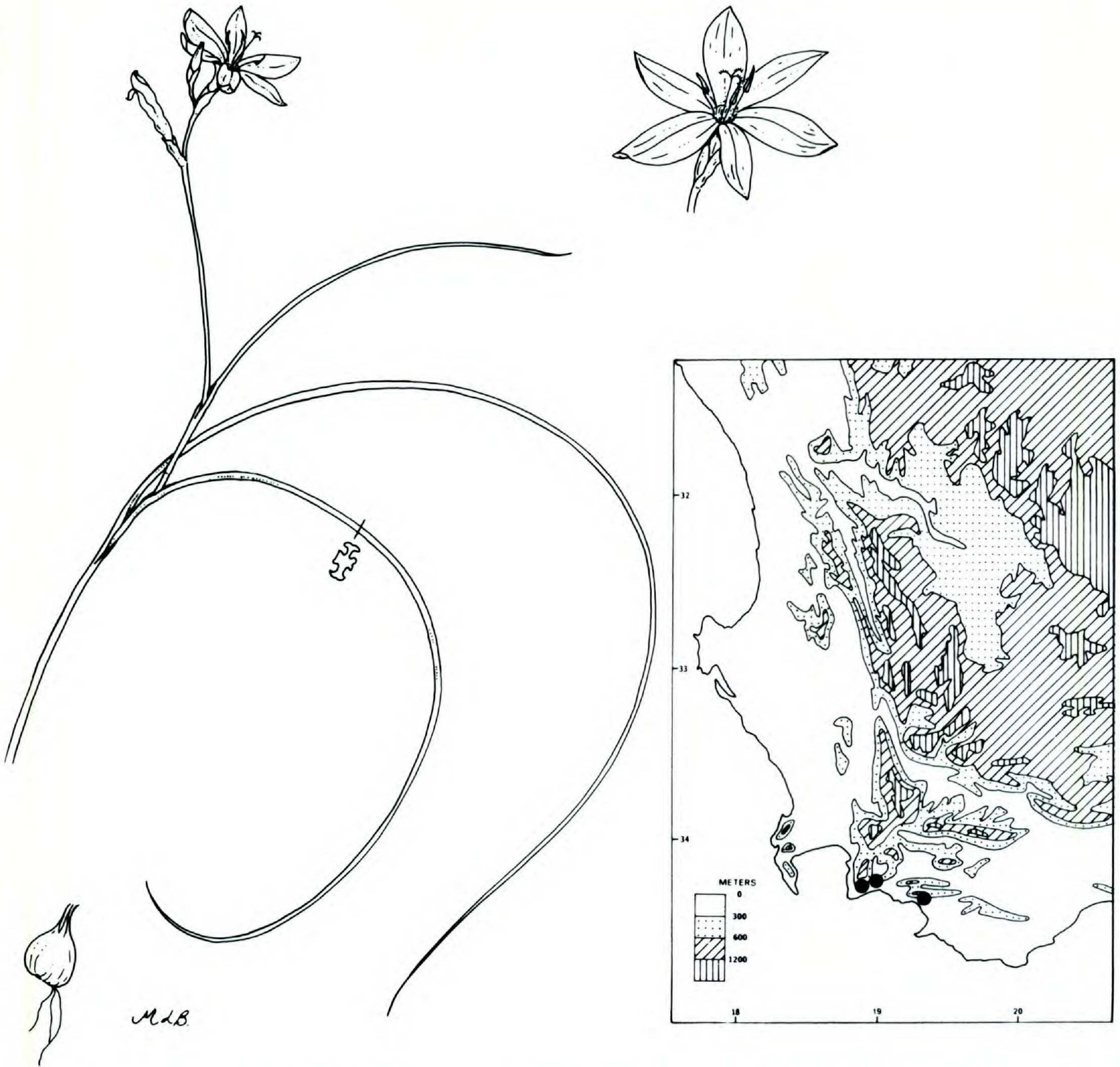


FIGURE 48. Morphology and distribution of *Geissorhiza cataractarum*. Habit $\times 0.5$; flower and corm life size; leaf section much enlarged (Goldblatt 5355, waterfall at Bettys Bay).

ceous, 6–9 mm long, the upper margin membranous. *Flower* stellate, pale blue-mauve, with a white center; *perianth tube* 4–6 mm long, usually reaching to about the apex of the bracts or slightly shorter; *tepals* 14–20 mm long, elliptic, 6–8 mm wide. *Filaments* 10 mm long; *anthers* 3(–4) mm long. *Ovary* ca. 2 mm long; *style* dividing near the apex of the anthers, branches recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (Goldblatt 5355).

Flowering time. Late November to mid-January.

Distribution. Wet, dripping south-facing cliffs

and waterfalls in the mountains between Bettys Bay and Hermanus. Figure 48.

Geissorhiza cataractarum has a restricted distribution, occurring in isolated sites along an approximately 40 kilometer stretch of mountains, on the coast between Bettys Bay and Hermanus. It is a late flowering species, blooming in summer, from December until mid-January. Plants grow in damp moss on continually moist and dripping, south-facing cliffs that remain wet even during the dry Cape summer, an unusual habitat for *Geissorhiza*. This niche is shared with the red-flowered orchid, *Disa uniflora*, the rare,

monotypic *Unigenes* (Campanulaceae) and a few other small moisture and shade-loving plants. *Geissorhiza cataractarum* is apparently related to the *G. umbrosa*–*G. hesperanthoides* alliance and is assigned to section *Ixiopsis*. It is unusual in its habitat and in its particularly delicate corm tunics, that are distinctive even for the section where membranous to fibrous tunics are characteristic. The tunics of *G. cataractarum* seldom accumulate as they do in other species, but decay entirely within a year. Only occasionally can the remains of old tunics be seen in herbarium collections.

In the Klein River Mountains around Hermanus in the east of its range, a second species, *Geissorhiza bryicola* (subgenus *Geissorhiza*) occurs in similar habitats, together with *G. cataractarum*, *G. bryicola* flowering from October to November and *G. cataractarum* from December to January. *Geissorhiza bryicola* has small white flowers with unequal stamens, persistent, brown imbricate corm tunics and a nearly plane leaf. The two are unlikely to be confused and despite their similar habitat, are believed to be unrelated, and are assigned to different subgenera.

Specimens examined. SOUTH AFRICA. CAPE: 3428 (Simonstown) Platteberg, 2,000 ft., in moss (BD), *Stokoe s.n.* (BOL 31908, SAM 58006); kloof near Bettys Bay, *Rourke s.n.* (NBG 60746); waterfall, near Bettys Bay, *Loubser 921* (NBG); Bettys Bay, dripping cliffs, ca. 1,000 ft., in moss, *Goldblatt 5355* (BOL, BR, E, K, NBG, NSW, P, PRE, S, US, WAG).

3419 (Caledon) Palmiet River Mts. (AC), *Stokoe 920* (PRE), *Stokoe s.n.* (BOL 17519); Vogelgat Nature Reserve, Secret Falls, mossy banks on waterfall in mist spray (AD), *Williams 3404* (MO).

40. *Geissorhiza nubigena* Goldbl., sp. nov. TYPE: South Africa. Cape: S slopes of Victoria Peak, *Goldblatt 6827* (holotype, MO; isotypes, K, NBG, PRE, S, US, WAG). FIGURES 5, 49.

Planta 15–30 cm alta, tunicis cormi fibrosis reticulatis, foliis 3, inferioribus duobus linearibus quadrisulcatis, superiore vaginanti, caule erecto, spica 1–5 floribus, floribus hypocrateriformibus roseis, tubo 10–18 mm longo, tepalis 17–22 mm longis, antheris 5–6 mm longis.

Plants 15–30 cm high. *Corm* globose, flattened below, 5–9 mm diam., tunics of fine, pale reticulate fibers, sometimes with papery, fragmented layers between, fibers usually extending upwards in a neck. *Cataphyll* membranous, becoming fibrous below or not evident. *Leaves* 3 (rarely 2), linear, 2–3 mm wide, the margins and midrib much thickened and with 2 narrow grooves on each surface, the lowermost leaf basal, the second inserted near ground level, sheathing the lower

part of the stem for a short distance, the uppermost leaf inserted in the middle part of the stem and sometimes sheathing entirely or with a short free apex. *Stem* more or less erect, very rarely branched. *Spike* flexuose, 1–5-flowered; *bracts* ca. 10 mm long, herbaceous, reddish above, often with hyaline apices, the inner shorter and narrower than the outer. *Flower* hypocrateriform, facing to one side, the tepals extended at right angles to the tube, rose pink; *perianth tube* 10–18 mm long, cylindric, reaching beyond apex of bracts on opening and becoming well-exserted; *tepals* 17–22 mm long, oblanceolate, to 9 mm wide. *Filaments* 8–12 mm long; *anthers* 5–6 mm long, yellow. *Ovary* 2–3 mm long, *style* exceeding the stamens, becoming declinate, branches 3–4 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. January.

Distribution. Middle to upper altitudes in the Hottentots Holland and Kogelberg Mountains. Figure 49.

Geissorhiza nubigena is clearly allied to the more widespread montane *G. hesperanthoides*, and it has the unusual fibrous corm tunics of this species. It has until now usually been included in this species. It is, however, not only larger in most respects than *G. hesperanthoides*, but particularly so in its perianth tube which is some 10–18 mm long and at anthesis well-exserted from the bracts. In contrast, the perianth tube of *G. hesperanthoides* is only 5–8 mm long at anthesis, extending to 7–10 mm in older flowers and typically not or barely exserted from the bracts. The flowers apparently also differ significantly. Those of *G. nubigena* are rose pink and have tepals 17–22 mm long and to 9 mm wide and extend at right angles to the tube, while in *G. hesperanthoides* the flowers are blue-violet and the tepals are 12–20 mm long, to 8 mm wide and typically somewhat cupped and relatively broader.

The range of *Geissorhiza nubigena* is completely within that of *G. hesperanthoides*. It extends from Kogelberg through the Hottentots Holland Mountains to Victoria Peak. *Geissorhiza hesperanthoides* occurs throughout this area, but extends to the north and to the southeast, through the Klein River and Bredasdorp Mountains. *Geissorhiza nubigena* appears to favor somewhat drier, better drained situations than *G. hesperanthoides* which usually grows in semi-marshy places.

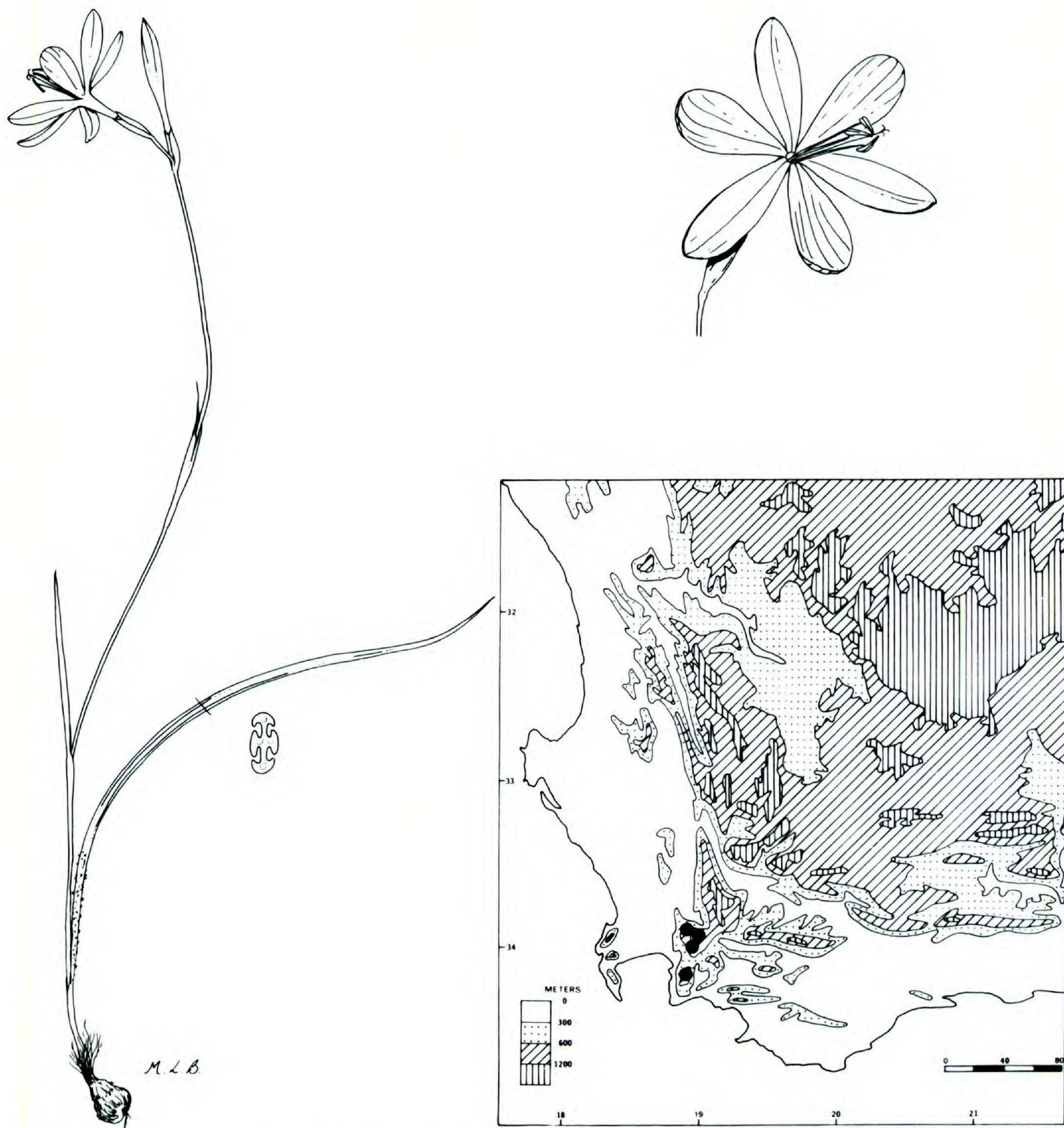


FIGURE 49. Morphology and distribution of *Geissorhiza nubigena*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6827, Victoria Peak).

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Jonkershoek (DD), Rycroft 1482 (SAM).

3418 (Simonstown) Kogelberg, upper S slopes, 3,500–4,000 ft. (BB), Esterhuysen 33120A (BOL, MO); Kogelberg, Five Beacon Ridge, 3,000–3,500 ft., Esterhuysen 9993 (BOL); Kogelberg, 900 m, Boucher 2053 (PRE, STE); Hottentots Holland, N of Somerset Sneeu-kop, shady cliffs, 3,500 ft., Esterhuysen 9723 (BOL, K); Sneeu-kop, Hottentots Holland Mts., Begley s.n. (SAM 10363); head of Landdrost Kloof, old fire trace, ca. 4,000 ft., Esterhuysen 32559 (BOL); Steenbras Peak, Kogelberg State Forest, Boucher 2791 (STE), 2718 (PRE).

3419 (Caledon) Victoria Peak, steep rocky upper slopes and on marshy sites on approach to peak, ca. 4,500 ft. (AA), Esterhuysen 33080 (BOL); Victoria Peak,

4,500 ft., Esterhuysen 14376 (BOL), 33111 (BOL); Victoria Peak, 5,100 ft., at foot of shale band, Haynes & Kruger 755 (STE); E slopes of Victoria Peak, Goldblatt 6827 (K, MO, NBG, PRE, S, US, WAG).

SECTION ENGYSIPHON

7. Section **Engysiphon** (Lewis) Goldbl., stat. nov.
Engysiphon Lewis, J. S. African Bot. 7: 19–24. 1941. LECTOTYPE: *G. exscapa* (Thunb.) Goldbl.

Acidanthera Hochst. sensu Baker, Fl. Cap. 6: 130–134. 1896, pro parte.

Corm tunics hard, woody, *leaves* ensiform to

linear, either with heavily thickened margins and midrib, or with the margins raised and winged and curving around the poorly thickened midrib and nearly terete, *spike* few to several flowered, *bracts* herbaceous, the inner membranous and usually less than half as long as the outer, *flower* declinate, the tube long to very long, reaching to or well exceeding the apex of the bracts, stamens equal.

Species. 7.

- 41. *Geissorhiza brevituba* (Lewis) Goldbl., comb. nov.** *Engysiphon brevitubus* Lewis, J. S. African Bot. 7: 24. 1941. TYPE: South Africa. Cape: top of Piketberg Mt., *H. Bolus s.n.* (lectotype, BOL 13651, here designated; isolecotypes, BM, K, PRE). FIGURE 50.

Plants 12–20 cm high. *Corm* globose, 15(–20) mm diam., tunics dark brown, concentric, layers fragmenting irregularly, segments drawn into short points above. *Cataphyll* pale, membranous, apparently solitary. *Leaves* usually 3, linear to narrowly ensiform, sticky on the sheath and lamina, and with sand adhering, the margins expanded at right angles to the blade, the midrib also enlarged and winged, the blade thus broadly 2-grooved on each surface, the lowermost leaf basal, largest, as long or slightly exceeding the spike, the other leaves short, becoming bract-like and sheathing for half their length, the lower of these basal or sub-basal, the upper inserted in the middle part of the stem. *Stem* erect, flexed above the sheath of the uppermost leaf and at the base of the spike, usually unbranched. *Spike* 1–3-flowered, flexuose; *bracts* 15–20 mm long, herbaceous, the inner membranous, shorter than the outer, ca. 12 mm long. *Flower* zygomorphic, stamens and style declinate, deep pink with darker veins; *perianth tube* ca. 8 mm long, not exerted from the bracts, widening towards the throat; *tepals* 25–30 mm long, 9–11(–13) mm wide, the outer wider and shorter than the inner. *Filaments* unilateral and declinate, held above the lowermost tepal; *anthers* unilateral, ca. 6.5 mm long. *Ovary* 3–4 mm long, *style* declinate, curved under the filaments, dividing near the apex of the anthers, branches ca. 4 mm long, ultimately recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (Goldblatt 204).

Flowering time. September.

Distribution. Stony mountain soil in low fynbos, Piketberg Mountains. Figure 50.

Geissorhiza brevituba is distinctive in section *Engysiphon*, in having a relatively short perianth tube, some 8 mm long, substantially shorter than the floral bracts. The bracts themselves are also relatively short for the alliance, being 15–20 mm long while the inner bract is not as short as in the other species of the section. In its other characteristics it is typical of the section having a zygomorphic flower with declinate stamens and style, the peculiar tepals with darker veins, and the single well-developed leaf with thickened and sticky margins and midrib. It is apparently most closely allied to *G. schinzii*, a species that occurs in the Caledon district, well to the southeast. This species also has a relatively short tube, some 24–32 mm long and about as long as the bracts, as well as quite broad tepals. Lewis (1941) suggested that *G. brevituba* with its short perianth tube may be closest to the ancestral type of *Engysiphon*, and it clearly has a combination of primitive features of the section. *Geissorhiza brevituba* has a very restricted distribution, having been recorded only from the Piketberg Mountains of the western Cape. It is relatively common here and is especially abundant after the veld has been burned the previous summer or autumn.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) farm Waboom, slopes of Zebrakop (DB), *Taylor 5339A* (STE); top of Piketberg Mt. (AC), *H. Bolus s.n.* (BM, BOL 13651, PRE), *Barker 6713* (NBG), *Martin 855* (NBG), *1053* (NBG), *Lewis 6215* (MO, NBG), *Goldblatt 204* (BOL), *De Vos s.n.* (STE); Piketberg, *Guthrie 2705* (BOL).

- 42. *Geissorhiza schinzii* (Baker) Goldbl., comb. nov.** *Acidanthera schinzii* Baker, Kew Bull. 1906: 27. 1906. *Engysiphon schinzii* (Baker) Lewis, J. S. African Bot. 7: 22. 1941. TYPE: South Africa. Cape: Houw Hoek, *Penther 587* (lectotype, Z, here designated; isolecotype, K). FIGURE 51.

Gladiolus costatus Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 38. 1827 et ms., nom. nud.

Plants (10–)12–20 cm high. *Corm* globose, asymmetric, flattened below on one side, 12–18 mm diam., tunics concentric, dark brown, fragmenting irregularly, segments drawn into 15 mm long cusps above. *Cataphyll* membranous, pale, evidently solitary. *Leaves* usually 3, erect to falcate, 4–6 mm wide, sticky below and on the margins and midrib and usually with sand adhering, the margins enlarged and extending at right angles to lamina, the midrib also enlarged and

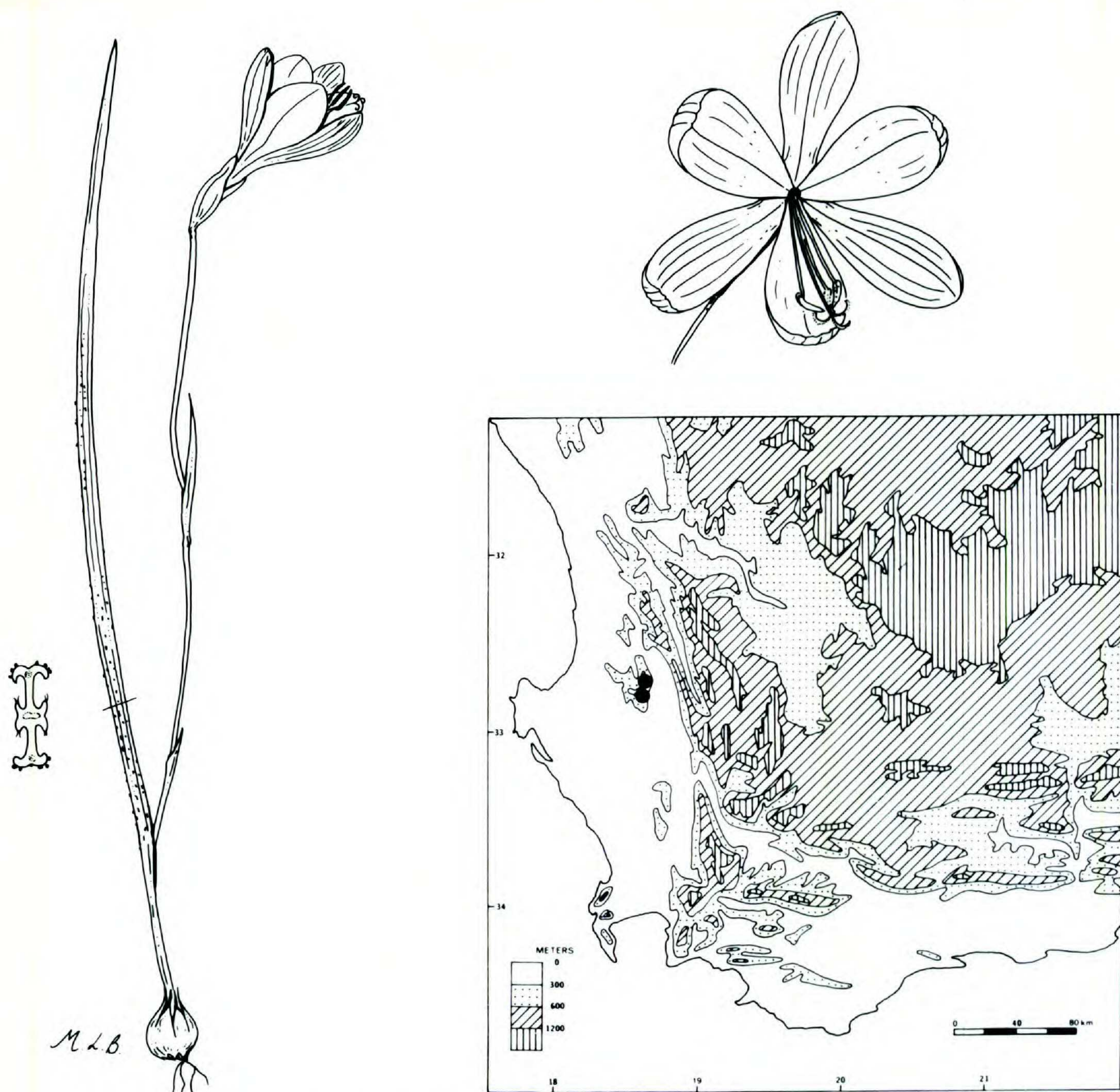


FIGURE 50. Morphology and distribution of *Geissorhiza brevituba*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt s.n.* no voucher, Piketberg Mts.).

winged and thus the blade with 2 wide grooves running the length of each surface, the lowermost largest, usually slightly longer than the spike, the second leaf basal or sub-basal, short, the third inserted in the mid part of the stem, both sheathing for about half their length. *Stem* inclined, flexed above the sheaths of the two upper leaves, unbranched. *Spike* 1–4-flowered, flexuose; *outer bracts* (20–)25–40 mm long, herbaceous, the inner much shorter and concealed by the outer. *Flower* zygomorphic, with the stamens and style declinate, tepals pink with darker veins; *perianth tube* 24–32 mm long, cylindric, usually emerging shortly from or occasionally somewhat shorter than the bracts; *tepals* 35–40 mm long, unequal,

9–15 mm wide, the outer shorter and broader than the inner. *Filaments* ca. 20 mm long, unilateral and declinate, held above the lowermost tepal; *anthers* 6–7 mm long, unilateral, horizontal. *Ovary* 5–6 mm long, *style* declinate, curved under the filaments, dividing near or beyond the apex of the anthers, *branches* ca. 3.5 mm long, ultimately recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. Late August to early October.

Distribution. Caledon district, mainly montane, in sandy soils. Figure 51.

Geissorhiza schinzii is common throughout the

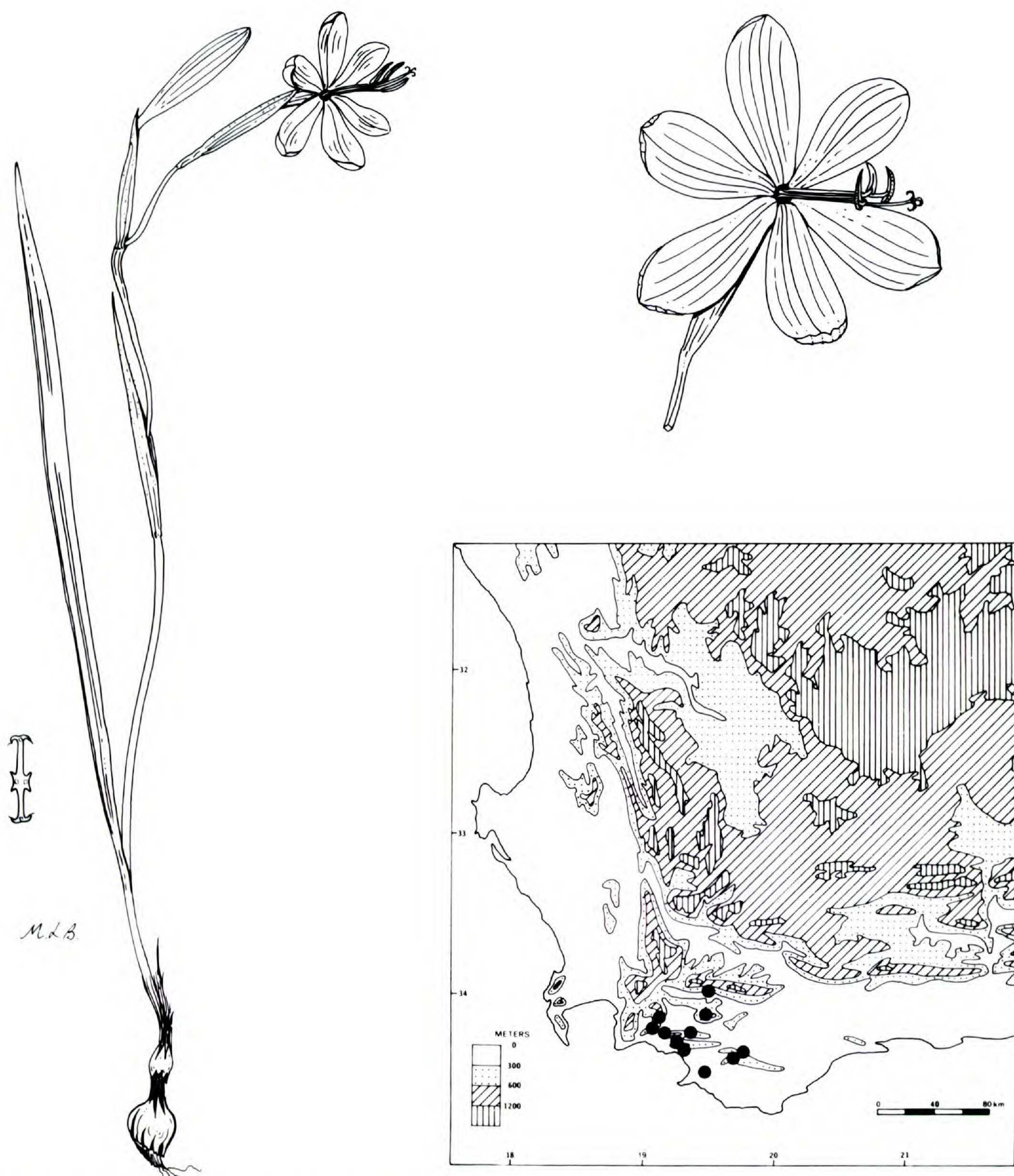


FIGURE 51. Morphology and distribution of *Geissorhiza schinzii*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 372, Houw Hoek Pass).

Caledon district, where it occurs in stony sandstone derived soil in the mountains and along the coast. It blooms well only after a veld fire the previous summer but can sometimes be seen in low fynbos in unburned vegetation. The large pink, delicately veined flowers with relatively broad tepals are distinctive, and *G. schinzii* should not be confused with other species of section *Engysiphon*. It is sometimes difficult to distin-

guish from *G. confusa* (*Engysiphon exscapus* sensu Lewis), but this species has cream to pale yellow flowers, a typically longer perianth tube, and proportionately narrower tepals that are usually shorter than the tube, whereas the tepals of *G. schinzii* are broad and as long or a little longer than the perianth tube.

Specimens examined. SOUTH AFRICA. CAPE: 3419 (Caledon) Houw Hoek (AA), Thorne s.n. (NBG 62250),

Gillett 897 (STE), Lewis 1498 (SAM), Werdermann & Oberdieck 158 (B, K, PRE), van Niekerk 644 (BOL, K, PRE); Houw Hoek Pass, Mauve 4604 (PRE, STE), Salter 4875 (BM, K), Goldblatt 372 (BOL), 3019 (MO); Bot River Pass, Compton 18519 (NBG); Zwartberg, Caledon (AB), Pappe s.n. (BM, SAM), Zeyher 1607 (BM, SAM); hills between Bot River and Hawston (AC), Barker 8789 (NBG); Honingklip farm, near Bot River, Barker 10509 (NBG); Shaws Pass (AD), Lewis 6096 (NBG, STE), Thompson 980 (K, PRE, STE), Gillett 4197 (BOL, K); Shaws Mt., *H. Bolus* s.n. (BOL 22562, PRE), Barker 9 (BOL, K); on road to Hemel-en-Aarde from Hermanus, Gillett 46 (BOL, STE); Fern Kloof Nature Reserve, Schmidt 29 (STE); Rotary Drive, Hermanus, Goldblatt 3008 (MO, PRE); Genadendal (BA), Prior s.n. (K); Keeromskloof, Salmonsdam Nature Reserve (BC), Hugo 2627 (STE); Fairfield (BD), Thomas s.n. (NBG); Baardscheerdersbos, between Elim and Gansbaai (DA), Stokoe s.n. (SAM 59825).

43. *Geissorhiza longifolia* (Lewis) Goldbl., comb. nov. *Engysiphon longifolius* Lewis, J. S. African Bot. 7: 23. 1941. TYPE: South Africa. Cape: Clanwilliam, Nieuwoudt Pass, Leighton s.n. (holotype, BOL 22558). FIGURES 6, 52.

Gladiolus costatus Ecklon ms. (Ecklon & Zeyher Irid. 97) pro parte, including also *G. exscapus*.

Plants 12–20 cm high. *Corm* globose, 12–16 mm diam., tunics brown, concentric, the layers fragmenting irregularly, the segments drawn into points above. *Cataphyll* pale, membranous, apparently solitary. *Leaves* 2–3, linear to ensiform, sticky on the sheath, margins and midrib and with sand adhering, the margins expanded at right angles to blade, midrib also enlarged and winged, blade thus broadly 2-grooved on each surface, the lowermost leaf basal, largest, usually exceeding the spike, to 28 cm long, the other leaves very short, becoming bract-like, and sheathing for half their length, the lower of these basal or sub-basal, the upper inserted in the mid part of the stem. *Stem* inclined, flexed above the sheath of the second leaf and at the base of the spike, occasionally with a short branch. *Spike* (2–)4–9-flowered, nearly horizontal, flexuose; *outer bracts* (14–)16–25 mm long, herbaceous, the inner membranous, about half as long. *Flower* zygomorphic, stamens and style declinate, the tepals white with pale pink veins, these sometimes coloring late, turning pink on fading; *perianth tube* 14–20(–25) mm long, shortly exserted from the bracts, curving near the apex; *tepals* 17–27 mm long, (5–)7–9 mm wide, the outer wider and shorter than the inner. *Filaments* unilateral and declinate, held above the lowermost tepal, 10–

15 mm long; *anthers* unilateral, horizontal, 4–6 mm long. *Ovary* 3–4 mm long, *style* declinate, curving below the filaments, dividing near the apex of the anthers, branches 2–3 mm long, ultimately recurved. *Capsule* oblong to narrowly obovoid, 12–18 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 122, 6267).

Flowering time. September to October.

Distribution. Stony soil on shale or sand, Olifants River Valley and the mountains from Pikeniers Kloof to Gifberg. Figure 52.

Geissorhiza longifolia has been known since at least the 1820s when specimens were collected by Ecklon and Zeyher in the Olifants River Valley (Ecklon & Zeyher Irid. 97). This collection, fairly widely distributed in herbaria, is usually mixed comprising also *G. confusa* and *G. exscapa* and it was to the latter (as *Acidanthera tubulosa*) that specimens were subsequently assigned. Ecklon gave specimens of this collection number the ms. name *Gladiolus costatus*, but this epithet was used in print (Ecklon, 1827) only for specimens from the Caledon district, now *G. schinzii*. Thus it was only when Lewis (1941) published her study of those species of *Acidanthera* that she assigned to *Engysiphon*, that *G. longifolia* was formally described.

The species has a fairly wide range, extending from Michells Pass northwards along the north-south trending western Cape mountains as far as the Gifberg. It grows most frequently in heavier soils, either in stony shale or in light clay, this in contrast to the other species of section *Engysiphon*, which grow in coarse quartzitic sand. *Geissorhiza longifolia* occurs both at lower altitudes, where clay soils are common, or in the mountains at low to middle elevations, but then most often in the shale band of the predominantly sandstone Table Mountain System.

Geissorhiza longifolia is distinctive in section *Engysiphon* in having comparatively small, white or pale pink flowers with a short perianth tube 14–20(–25) mm long and narrow tepals 17–27 mm long and 5–9 mm wide. It is sometimes confused with *G. confusa*, the two being similar in overall appearance. *Geissorhiza confusa*, however, has larger cream-colored flowers with a tube 25–40 mm long and tepals 28–40 mm long and 7–10 mm wide.

Specimens examined. SOUTH AFRICA. CAPE: 3118 (Vanrhynsdorp) slopes of Gifberg (DC), Goldblatt 375 (BOL), Phillips 7509 (NBG), Compton 20776 (NBG), Werdermann & Oberdieck 497 (B, K, PRE).

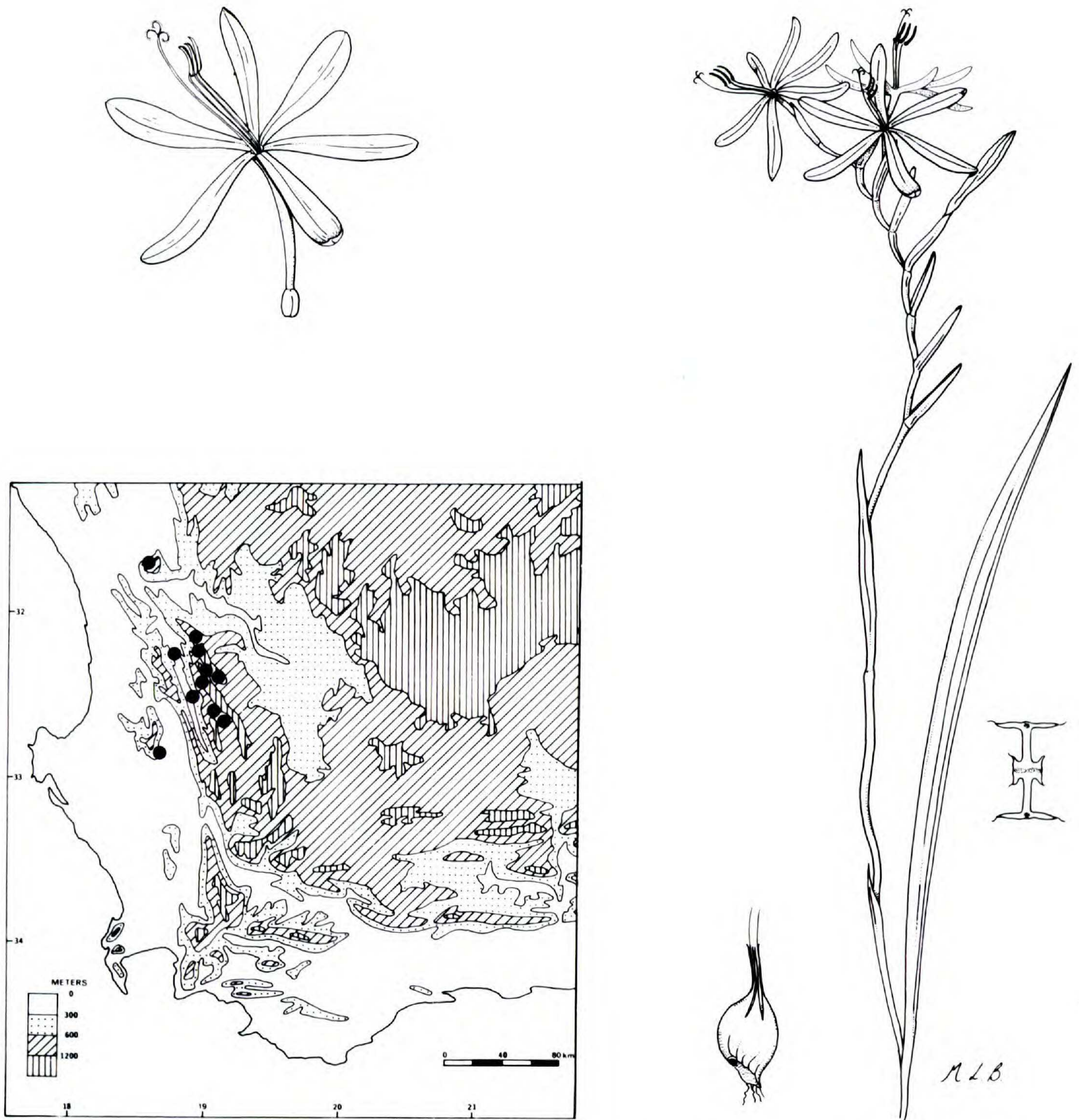


FIGURE 52. Morphology and distribution of *Geissorhiza longifolia*. Habit and corm $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt 6267*, N of Citrusdal).

3218 (Clanwilliam) 10 mi. N of Clanwilliam (BB), *Compton 17116* (NBG, PRE); "Clanwilliam, am Fluss Olifantrivier," *Ecklon & Zeyher Irid.* 97 (MO); Langvallei (BC), *Compton 5418* (BOL, NBG); Lamberts-hoek Berg (BC-BD), *Barker 6704* (NBG); summit of the ridge between Jakkals Valley and Kransvlei, sandy ground, 2,100 ft. (BD), *Oliver 3876* (STE); Kransvlei Berg, *Barker 4755* (NBG); old Clanwilliam road, S of the Algeria turnoff, *Goldblatt 287* (BOL); De Hoek, Piketberg (DC), *Lewis 1865* (NBG).

3219 (Wuppertal) E slopes of Pakhuis Pass (AA), *Goldblatt 6395* (MO); Pakhuis Pass in clay soil, *Leipoldt 794* (SAM), *Barker 4701* (NBG); Bosch Kloof, Cedarberg, *Pocock 248* (STE); Duiwelsgat, Cedarberg

Mts. (AC), *Esterhuysen 13116* (BOL); Nieuwoudt Pass, 2,000 ft., *Leighton s.n.* (BOL 22558); Uitkyk Pass, *Barker 257* (NBG); Algeria, *Lewis s.n.* (BOL 22270); Kriedouw Krans Pass, between Alpha and Algeria, *Gillett 4121* (BOL, MO); Elands Kloof Pass (CA), *Barker 3102* (BOL, NBG); W end of Elands Kloof Pass, *Lewis 2515* (PRE, SAM 61822); Elands Kloof near Citrusdal, *Lewis 1340* (SAM), *Leighton 1252* (BOL); shale hillside N of Citrusdal, *Goldblatt 6267* (MO, PRE, S); Citrusdal rocks, *Barker 3766* (NBG); Elandskloof Bridge, 10 mi. SE of Citrusdal, *Maguire 1809* (NBG).

3319 (Worcester) flats below Michells Pass (AC), *Guthrie 3400* (NBG).

WITHOUT PRECISE LOCALITY: banks of the Olifants

River, 400 ft., *Schlechter 5030* (BOL, Z); sandveld between Greys Pass and Graafwater, *Leipoldt 3604* (BOL); Mostert Berg, *MacOwan 2506* (SAM); Clanwilliam, *Ecklon s.n.* (K); Olifants River Valley, *Ecklon & Zeyher s.n.* (76) (BM, PRE, Z).

- 44. *Geissorhiza confusa*** Goldbl., sp. nov. TYPE: South Africa. Cape: Bains Kloof, *Schlechter 9162* (holotype, MO; isotypes, G, K). FIGURE 53.

Engysiphon exscapus (Thunb.) Lewis sensu Lewis, J. S. African Bot. 7: 23–24. 1941, pro parte exclusion.

Sphaerospora exscapa (Thunb.) Klatt, Linnaea 32: 725. 1863, pro parte nom. illeg. gen. illeg. hom. (name applied to several allied species by Klatt).

Acidanthera tubulosa Baker, J. Linn. Soc., Bot. 16: 160. 1876, Handb. Irid. 186. 1892, Fl. Cap. 6: 132. 1896, pro parte (applied also to *G. exscapa*). The identity of the type specimen of this species is uncertain and the name is here rejected.

Freesia costata Ecklon ms., pro parte (also including *G. longifolia*).

Macrospathe secunda Pappe ms.

Planta 12–30 cm alta, foliis 2–3, inferiore basali ensiforme 4-sulcatoque, superioribus caulem vaginantibus, caule plerumque erecto, bracteis (30–)40–60 mm longis, spica florum 1–4(–8), floribus zygomorphis declinatis cremeo-flavis, tubo 25–40(–50) mm longo, tepalis 28–40 mm longis, antheris 6–8 mm longis, capsulo 15–23(–28) mm longo.

Plants 12–30 cm high. *Corm* globose, 12–18 mm diam., tunics brown, concentric, layers fragmenting irregularly, the sections drawn into long points above. *Cataphyll* pale, membranous, apparently solitary. *Leaves* 2–3, linear to ensiform or sometimes falcate, 3–7 mm wide, sticky on the sheath, margins, and midrib and with sand adhering, the margins and midrib heavily thickened, blade thus broadly 2-grooved on each surface, the lowermost leaf basal, largest, usually shortly exceeding the spike, to 30 cm long, the other leaves very short, becoming bract-like and sheathing for at least half their length, lower of these basal or sub-basal, the upper inserted in the mid part of the stem. *Stem* more or less erect, flexed at the base of the spike, rarely with a short branch. *Spike* inclined, 1–4(–8)-flowered, flexuose; *outer bracts* (30–)40–50(–60) mm long, herbaceous, the inner membranous, about half as long. *Flower* zygomorphic, the stamens and style declinate, cream to ivory with pale pink veins, turning pink on fading; *perianth tube* 25–40(–50) mm long, reaching to the apex of, or exerted to 15 mm from the bracts, curving near the apex; *tepals* 28–40 mm long, 7–10 mm wide, the outer wider and shorter than the inner. *Fil-*

aments unilateral and declinate, held above the lowermost tepal; *anthers* unilateral, horizontal, 6–8 mm long. *Ovary* 5–8 mm long, *style* declinate, curving under the filaments, dividing near the apex of the anthers, branches 3–4 mm long, ultimately recurved. *Capsule* oblong to linear, 15–23(–28) mm long. *Chromosome number*, $2n = 26$ (Goldblatt 483).

Flowering time. October to December (to mid-January).

Distribution. Stony mountain soil in low fynbos, extending from French Hoek Pass to Gifberg. Figure 53.

Geissorhiza confusa has long been confused with other species of section *Engysiphon*. Baker (1892, 1896) placed specimens of this species in *Acidanthera tubulosa*, based on Houttuyn's interpretation of *Ixia tubulosa* Burman f., but excluding Burman's *Ixia tubulosa* itself, which he treated as a species of *Babiana*. I am treating *A. tubulosa* here as a nomenclaturally new species dating from 1878 when Baker proposed the combination *A. tubulosa* (Houtt.) Baker. It is thus typified by the figure published by Houttuyn, a good representation of a specimen in the Burman Herbarium in Geneva. This plant has long bracts, 45–54 mm long, flowers with a tube reaching only to the apex of the bracts, tepals to 22 mm long and anthers 5 mm long. The leaf is incomplete but appears to be of the kind with winged margins and poorly developed midrib. While the identity of this plant is questionable, it clearly is not the species here named *G. confusa*, which has shorter bracts, a larger flower, and broad leaves with a well-developed midrib. It matches both *G. exscapa* and *G. tenella* fairly well, and it is discussed in more detail under these species.

In 1941, Lewis used the name *Engysiphon exscapus* for *Geissorhiza confusa* believing that it was conspecific with Thunberg's *Gladiolus exscapus*, even though she had not then seen the type material of this species. As explained in detail under *Geissorhiza exscapa*, Thunberg's species is the plant Lewis named *E. longitubus*. The name must now therefore be applied to this species. This leaves a widespread and relatively well known plant without a name, and I propose for it the epithet '*confusa*,' which seems appropriate in view of the series of misunderstandings surrounding the name of this species.

Geissorhiza confusa is common in the western Cape mountains and extends from French Hoek Pass northwards through the Cold Bokkeveld and

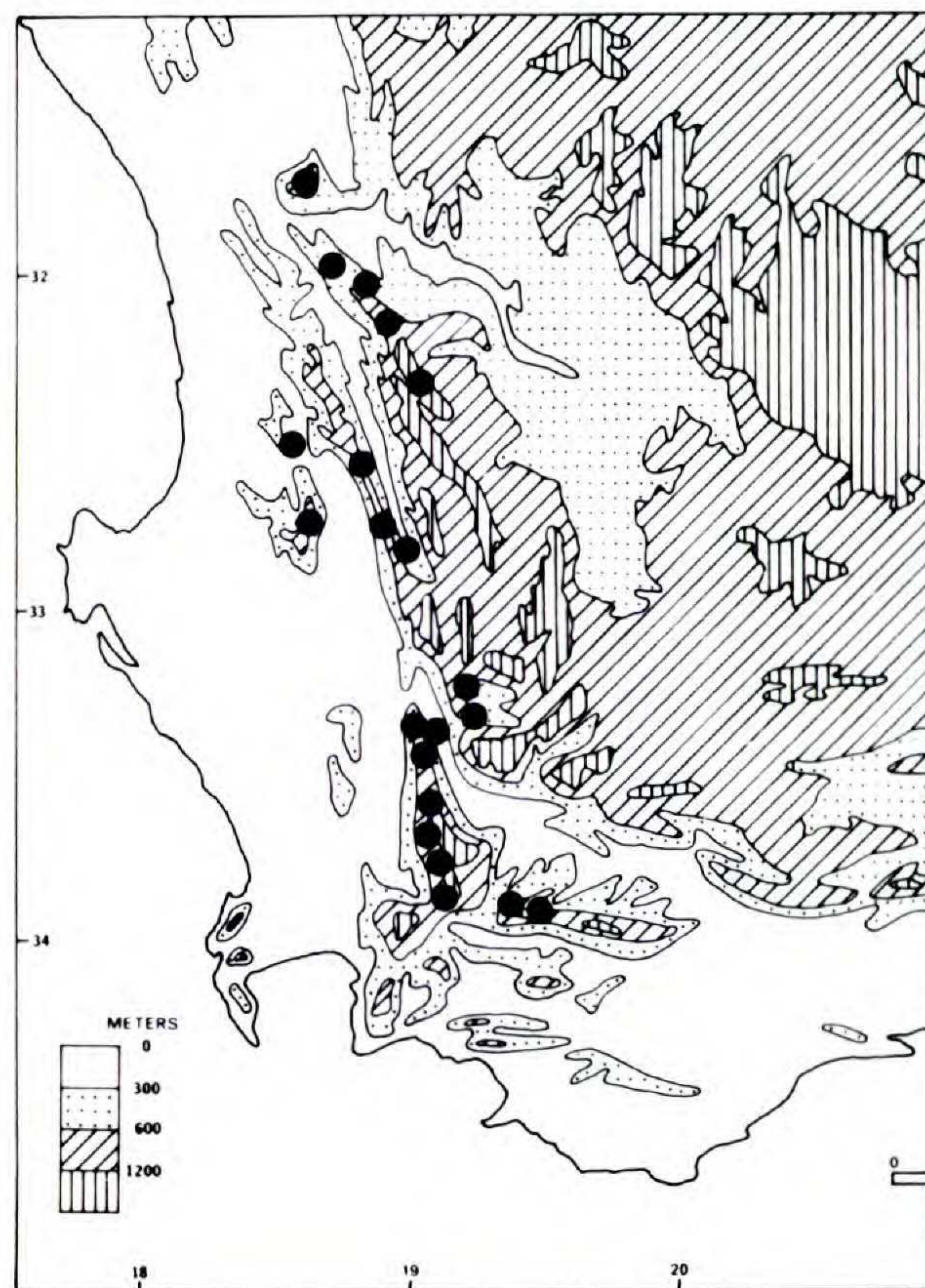


FIGURE 53. Morphology and distribution of *Geissorhiza confusa*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6836, Bains Kloof).

Cedarberg Mountains to the Gifberg, also occurring on the outlying Piketberg Mountains. It grows on open stony slopes and flowers late in the year, sometimes into January. Its deep cream to almost yellow flowers are attractive and conspicuous when in bloom.

Several specimens that Lewis identified as *Geissorhiza confusa* (under the name *Engysiphon exscapus*), notably those from the Nieuwoudtville escarpment, have here been assigned to *G. exscapa*. These plants have a relatively long perianth tube not exerted from the bracts, often a feature of *G. confusa*, but all these specimens have the narrow, nearly terete leaf with margins raised into wings and poorly developed midrib characteristic of *G. exscapa*, while *G. confusa* invariably has a broader leaf with heavily thickened margins and midribs.

Geissorhiza confusa can occasionally be confused with the white- to pink-flowered *G. longifolia*, a short-tubed species with similar leaf

morphology, but usually a several flowered spike of smaller, shorter tubed flowers [tube 14–20 (–25) mm long]. Specimens from the Het Kruis area, north of the Piketberg, notably *Bond 558* and *Compton 15529* bear up to ten flowers, may be branched, and have smaller bracts than other collections of the species. These may represent hybrids with *G. longifolia*, but this species has not been recorded in the area.

Geissorhiza confusa may also sometimes be difficult to distinguish from *G. schinzii*, especially when dry. *Geissorhiza schinzii* is restricted to the Caledon district, where it grows in habitats similar to *G. confusa*. It has pink flowers with tepals 9–15 mm wide, much broader than those of *G. confusa* and a perianth tube 24–32 mm long that seldom extends beyond the bracts. In contrast, *G. confusa* has narrow tepals, 7–10 mm wide, and a tube 25–50 mm long that may be exerted for as much as 10 or 15 mm from the bracts.

Specimens examined. SOUTH AFRICA. CAPE: 3118 (Vanrhynsdorp) Nardouw Mts., near Clanwilliam, sandy plateau (AC), *Bayliss* 6107 (K, MO); Gifberg (AD), *Barker* 9573 (NBG, STE), *Goldblatt* 355 (BOL).

3218 (Clanwilliam) near Het Kruis (DA), *Bond* 558 (NBG), *Compton* 15529 (NBG), *Leighton* 83 (BOL); top of Greys Pass (DB), *Hall* 4186 (NBG); N side of the top of Versvelds Pass, Piketberg (DC), *Pillans* 7148 (BOL, K); Piketberg Mt., *Maguire* 1162 (BOL, NBG).

3219 (Wuppertal) Pakhuis Pass, near river camp (AA), *Barker* 10315 (NBG); De Hangen, cave on the N slopes of Nardouwsberg, *Esterhuysen* 32499A (BOL); Wuppertal, *Thode* A2086 (K); Klein Valley, Cedarberg (CA), *Taylor* 1839 (NBG, STE); Cardouw Pass (CC), *Barker* 7602 (NBG); Grootfontein, Olifants River Valley, SE of Grasruggens, 1,400 ft., *Oliver* 3969 (STE).

3319 (Worcester) foot of the mt. above Porterville (AA), *Loubser* 852 (NBG); mts. near Saron, *Schlechter* s.n. (S); Kluitjieskraal Forest Reserve, Zevenfontein, 1,600 ft., *Haynes* 243 (STE); Waterfall Forest Reserve, NE slopes of Ontongskop, 1,400 ft. (AC), *Haynes* 236 (STE); Tulbagh Mts. near Waterfall, *Herre* s.n. (STE 8973); Tulbagh Waterfall, *Compton* 12412 (NBG), *H. Bolus* 5253 (BOL, K); Castle Rocks, Ceres (AD), *Esterhuysen* 14705 (BOL, PRE); rocky slopes, Michells Pass, *Lewis* 5680 (NBG); Klein Berg, Hex River Mts., sandy plateau, *Esterhuysen* 9534 (BOL, K); Bains Kloof (CA), *Salter* 5118 (BM, BOL, K), *Barker* 636 (NBG), *Lewis* 855 (SAM 56196, K), *Thorne* s.n. (SAM 46473), *Compton* 16813 (NBG), *Goldblatt* 483 (BOL), *Schlechter* 9162 (BM, G, K, MO, PRE); slopes N of Bains Kloof, *Goldblatt* 6836 (MO, PRE); Baviaans Kloof, *Lewis* 980 (SAM); Haalsneuwkop, *Stokoe* s.n. (SAM 56191); Wemmershoek Valley, in stony sand (CC), *Esterhuysen* 17677 (BOL, NBG, PRE); Du Toits Kloof, *Drège* s.n. (*Gladiolus flexuosus* Ker α) (G, K, MO), *Jackson* s.n. (NBG 121302); Zachariashoek, Kasteelkloof catchment, *Smith* 67 (STE), *Haynes* 261 (STE); top of French Hoek Pass, *Salter* 4180 (BM, BOL, K); Drakenstein Mts., near French Hoek Pass, *Galpin* 12284 (K, PRE); E side of French Hoek Pass, *Compton* 8184 (NBG); Silver Streams, in Waterkloof, E of Villiersdorp (CD), *Oliver* 5486 (PRE, STE); Jonas Kop, at the second gate (DC), *Strauss* 74 (NBG);

WITHOUT PRECISE LOCALITY: Witsenberg and Skurfdeberg, Tulbagh, *Zeyher* 1607A (K, G); Caledon District, *Pappe* s.n. (*Macrosathe secunda* Pappé ms.) (K).

45. *Geissorhiza bonae-spei* Goldbl., sp. nov.

TYPE: South Africa. Cape: between Fish Hoek and Sun Valley, on N-facing slopes after fire, *Goldblatt* 5917 (holotype, MO; isotypes, K, PRE, S). FIGURE 54.

Engysiphon pictus (Foster) Lewis sensu Lewis, J. S. African Bot. 7: 21. 1941, Fl. Cape Penins. 252. 1950, pro parte excl. basion. (= *G. exscapa*).

Planta 12–20 cm alta, foliis 3 vel 2, inferiore longissimo basali tereto, marginibus alatis circum costis incurvatis, superiore caulem vaginante, caule erecto, spica florum 1–5, bracteis 2.5–3.7 cm longis, floribus zygomorphis declinatis carneis, tubo 20–30 mm longo, tepalis 24–27 mm longis, antheris 4–5 mm longis, capsulo 15–20 mm longo.

Plants 12–20 cm high. *Corm* globose, ca. 8 mm diam., asymmetric, with one side somewhat flattened below, tunics brown, concentric, fragmenting irregularly, segments drawn into short cusps above. *Cataphyll* membranous, evidently solitary, sometimes apparently lacking. *Leaves* usually 3, or 2, more or less terete, sticky on the sheath and blade and often covered with sand, the margins expanded into wings held at right angles to blade and curving inwards, thus making the leaf appear terete with 2 narrow longitudinal grooves, the lowermost leaf longest, basal, usually reaching to the apex of the spike, the second much shorter, also basal and often sticky, sheathing lower half of stem, free above, the uppermost leaf inserted in the mid part of the stem and sheathing for half to two-thirds its length, sometimes reduced and bract-like. *Stem* erect, simple, flexed above the sheathing parts of the leaves. *Spike* 1–5-flowered, flexuose; *outer bracts* green, 2.5–3.7 cm long, often dry towards apices, the inner membranous, much shorter than the outer. *Flower* zygomorphic with the stamens and style declinate, the tepals pale pink, deeper pink on the reverse and on the veins; *perianth tube* 20–30 mm long, slender, reaching the apex of the bracts or shortly exserted, curved near the throat; *tepals* oblong, obtuse, sometimes acuminate, 24–27 mm long, 5–7 mm wide, the inner somewhat narrower and longer than the outer. *Filaments* 14–16 mm long, unilateral and declinate, held above the lowermost tepal; *anthers* horizontal, more or less unilateral, 4–5 mm long. *Ovary* 4–5 mm long, *style* declinate, lying under the filaments, dividing near the mid part of the anthers, branches 2–3 mm long, recurved. *Capsule* oblong, 15–20 mm long, enclosed in the bracts. *Chromosome number*, $2n = 26$ (*Goldblatt* 5267).

Flowering time. Late September to mid-November.

Distribution. Stony, sandstone soils on slopes and flats in the southern Cape Peninsula; blooming mainly after fires. Figure 54.

Geissorhiza bonae-spei is closely allied to *G. tenella* and the two are sometimes difficult to distinguish when dry. *Geissorhiza bonae-spei* has large pink flowers that have tepals 24–27 mm long and 5–7 mm wide, and a tube 20–30 mm long, while the white-flowered *G. tenella* has shorter tepals 14–22 mm long and 3–4.5 mm wide, and a tube usually 30–40 mm long. The perianth tube and bracts of *G. tenella* are typi-

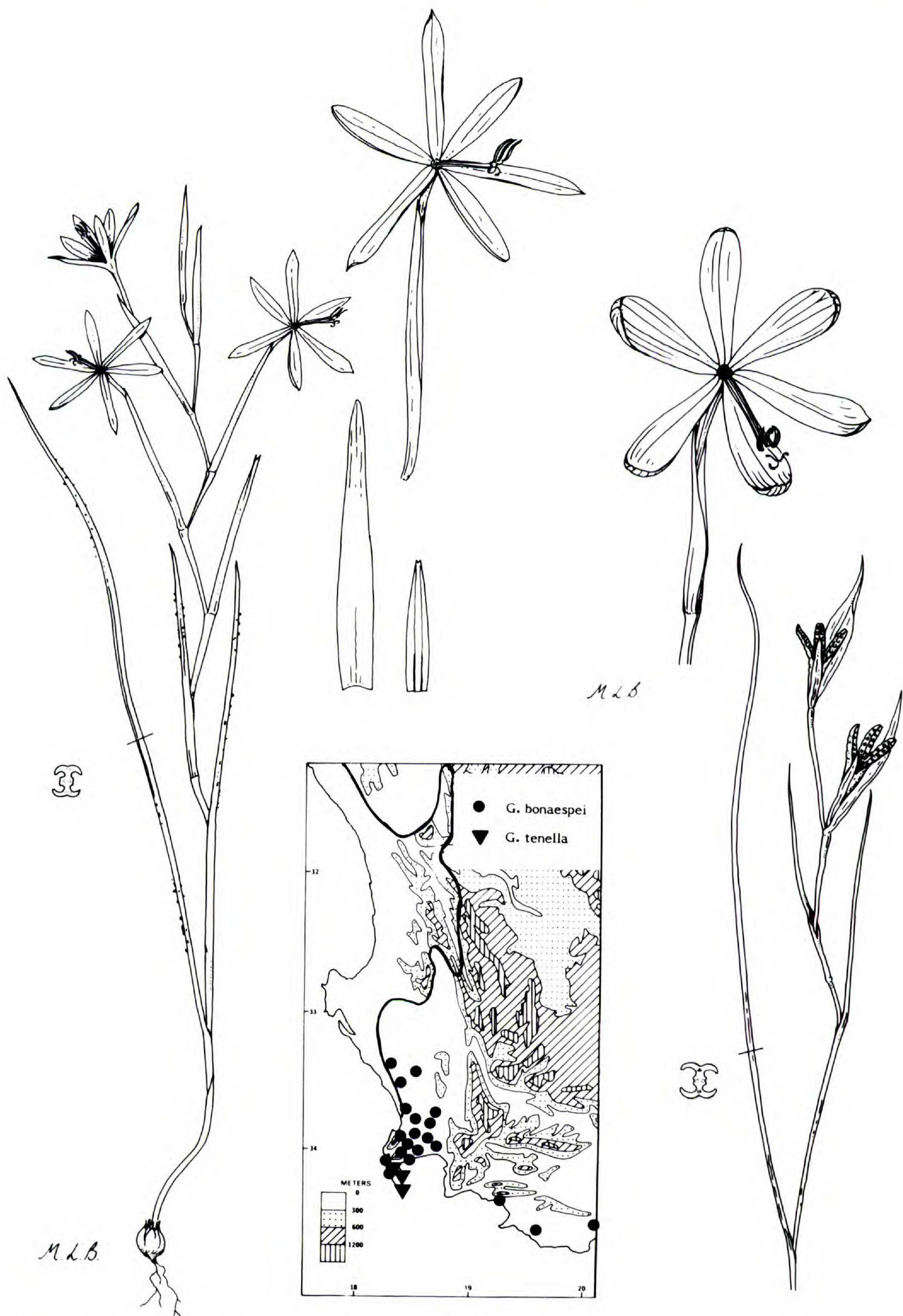


FIGURE 54. Morphology and distribution of *Geissorhiza tenella* (left) and *G. bonaespei* (right) with the main range of *G. exscapa* outlined. Habits $\times 0.5$; flowers and separated bracts life size; leaf sections much enlarged (*G. tenella*, Goldblatt 7111, near Koeberg; *G. bonaespei*, fruiting Goldblatt 5267, foot of Klaasjagersberg, flowering Goldblatt 5276, Fish Hoek Mts.).

cally longer than those of *G. bonae-spei* in spite of the larger tepals of the latter.

Lewis used the name *Engysiphon pictus* for this species, but this name is a nomen novum provided by Foster (1936) for the plant figured by Houttuyn (1780) as *Ixia tubulosa* Burm. f., the type of which is a species of *Babiana*, now *B. tubulosa* (Lewis, 1959). The identity of Houttuyn's plant, a drawing of a specimen in the Burman Herbarium in Geneva, is somewhat problematic, but it is probably *G. exscapus*. The specimen is incomplete, but what remains of the leaf indicates a more robust blade than that found in any collection of *G. bonae-spei* known. In addition, the floral bracts are 4.5–5.5 mm long, substantially longer than in any collection of *G. bonae-spei* that I have seen. It therefore seems almost certain that the name *E. pictus* must be applied to another species. *Geissorhiza bonae-spei* is evidently endemic to the southern Cape Peninsula where it occurs on stony flats and slopes. It blooms well only after a fire the previous summer, and although quite common throughout its range, it is not often seen. Despite its growing relatively near to Cape Town, it was apparently first collected only early this century, by H. Bolus. The locality for this collection, given as the Riversdale district, must be regarded, in the light of current knowledge, as incorrect.

Specimens examined. SOUTH AFRICA. CAPE: 3418 (Simonstown) Muizenberg Plateau (AB), *Kensit s.n.* (BOL 22564); Pecks Valley, Muizenberg, *H. Bolus s.n.* (BOL); Diep River flats, *Marloth 7154* (PRE); Clovelly, Cape Peninsula, *Walgate 409* (NBG); Fish Hoek Mt., *Barker 3248* (NBG), *Lewis 803* (SAM); near Fish Hoek, *Werdermann & Oberdieck 792* (K); between Fish Hoek and Sun Valley, on N-facing slopes after fire, *Goldblatt 5917* (K, MO, PRE, S); near Simonstown, *H. Bolus 4691* (BOL); hills W of Simonstown, *Fair sub Wolley Dod 2036* (BM, K); Klawer Valley, *Lewis 627* (SAM), *Salter 7825* (SAM), *Compton 5268* (BOL); burned lower slopes of Klaasjagersberg, *Goldblatt 5267* (K, MO); Patrys Vlei (AD), *Compton 12321* (NBG); slopes of Pauls Berg, Cape Point, *Barker 4296* (BOL, NBG), *Lewis 1497* (BM, SAM 38337); near Cirkels Vlei, *Salter 2846* (BM, BOL, K); near Buffels Bay, *Esterhuysen 19258* (BOL).

DOUBTFUL LOCALITY: Riversdale district, *H. Bolus 22561* (BOL).

46. *Geissorhiza tenella* Goldbl., nom. nov. pro *Acidanthera rosea* Schinz, Bull. Herb. Boissier, Ser. 2, 2: 222. 1894; Baker, Fl. Cap. 6: 132. 1896. TYPE: South Africa. Cape: "Spitze des Teufelberges bei Capstadt," 3,300 ft. ("montis Diaboli" on the label), *Schlechter 75* (lectotype, G, here designated; isolecto-

types, B, K). *Engysiphon roseus* (Schinz) Lewis, J. S. African Bot. 7: 21. 1941, Fl. Cape Penins. 252. 1950. FIGURE 54.

Acidanthera sabulosa Schltr., Bot. Jahrb. Syst. 27: 101. 1900. TYPE: South Africa. Cape: sand dunes near Eerste Rivier, *Schlechter 9025* (lectotype, B, here designated; isolectotypes, BM, G, K, MO).

Gladiolus tenellus Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 41. 1827, nom. nud. et ms. (*Ecklon & Zeyher Irid. 290*).

Plants (10–)15–30 cm high. *Corm* globose, 7–10 mm diam., asymmetric, with one side somewhat flattened below and extending downwards shortly, tunics brown, concentric, fragmenting irregularly, segments drawn into short cusps above. *Cataphyll* membranous, apparently solitary. *Leaves* usually 3, nearly terete, sticky on the sheath and sometimes on the blade, the margins expanded into wings raised at right angles to the blade and curving inward, the leaf thus appearing terete with 2 narrow grooves running its entire length, the midrib not, or very little thickened, the lowermost leaf longest, basal, reaching to the base of the spike, the second leaf also basal, sheathing the lower third of the stem, free above, the uppermost leaf inserted on the upper third of the stem and sheathing for about two-thirds of its length, often bract-like. *Stem* erect, slender, simple. *Spike* (1–)2–5-flowered; *outer bracts* green, (2–)3–4(–5) cm long, the inner membranous, half as long as the outer. *Flower* zygomorphic with the stamens and style declinate, the tepals white to pale pink, flushed pink on the reverse; *perianth tube* (20–)30–40(–50) mm long, slender, either reaching only to the apex of the bracts or exerted to 15(–25) mm, curved near the apex; *tepals* oblong to linear, acute, 14–23 mm long, 3–4.5 mm wide. *Filaments* ca. 14 mm long, unilateral and declinate, held above the lowermost tepal; *anthers* horizontal, (2.5–)3.5–4.5 mm long. *Ovary* ca. 4 mm long, *style* declinate, lying under the filaments, branching near the apex of the anthers, branches ca. 3 mm long. *Capsule* oblong, 12–20 mm long, enclosed in the bracts. *Chromosome number*, $2n = 26$ (*Goldblatt 7111*).

Flowering time. October to November (to mid-December).

Distribution. Sandy, seasonally wet flats, from Darling in the north to the Bredasdorp district in the east. Figure 54.

On transfer to *Geissorhiza*, *Engysiphon rosea* requires a new name as the existence of *G. rosea* N. E. Br. (a synonym of *G. heterostyla*) prevents

the transfer of this epithet to the genus. The name *G. tenella* is here proposed for the species. A second synonym, *Acidanthera sabulosa* Schltr. likewise cannot be used in *Geissorhiza*, as the name *G. sabulosa* Klatt (a synonym of *G. imbricata* subsp. *imbricata*) blocks its transfer. The epithet 'tenella,' as *Gladiolus tenellus*, was used for the species by Ecklon (1827) and on labels for his collection of the species from the Cape flats, but no description was ever provided. It seems appropriate to validate this name for the species.

Geissorhiza tenella apparently has a relatively wide range, occurring on sandy flats and plateaus from the west coast near Darling, across the Cape Flats and Agulhas Peninsula to Cape Infanta. It is allied to the very long-tubed west coast species, *G. exscapa*, and to the southern Cape Peninsula species, *G. bonae-spei*. These three species all share a similar and distinctive leaf, in which the margins have well-developed wings that curve over the blade, while the midrib is not, or only very little thickened. This gives the leaf a terete appearance especially when dry (Fig. 54). *Geissorhiza bonae-spei* is readily distinguished by its 20–30 mm long perianth tube and pink, relatively broad tepals, some 24–27 mm long and 5–7 mm wide, in contrast to a (20–)30–50 mm long tube and white, very narrow tepals, some 14–23 mm long and 3–4.5 mm wide of *G. tenella*.

Flower size is unusually variable in *Geissorhiza tenella*. Plants from the east of its range, in the Caledon and Bredasdorp districts (as well as some from the Cape Flats), have a relatively short perianth tube, some 24–30 mm long and tepals 12–15 mm long (*Compton 22185*, *Goldblatt 675*). Most specimens collected on the Cape Flats and along the west coast often have much larger flowers in which the tube may be 40–50 mm long and the tepals to 23 mm long. Such specimens approach *G. exscapa* in their flower size and the relationship between these two species is discussed further under *G. exscapa*.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Darling Flower Reserve (AC), *Lewis 5744* (NBG); Riverlands, sandy wet flats (BC), *Esterhuysen 35084* (BOL, MO); Pella turnoff, Mamre road (CA), *Barker 10351* (NBG); E of Melkbosch Strand, *Salter 4889* (BM, K); between Melkbosch Strand and Mamre, *L. Bolus s.n.* (BOL 19976, K); Melkbosch road (CD), *Barker 1980* (NBG); summit of Devils Peak, *Schlechter 75* (B, G, K); Table Mt. above Oranjezicht, *Marloth 10714* (PRE); Camp Ground, *Wolley Dod 3419* (BOL, K); Claremont Flats, *Guthrie 1347* (BOL); burned slopes between Melkbos turnoff and Koeberg (DC), *Goldblatt*

7111 (MO, STE, WAG); Kuilsrivier, *Pappe s.n.* (K, SAM 21118); Kuils River, *Worsdell s.n.* (K); Blackheath, flats SE of Leykor factory, *Oliver 4057* (K, PRE); Hercules Pillar (DD), *Barker 4855* (NBG); near Joostenberg, sandy flats, *Esterhuysen 16009* (BOL, NBG).

3418 (Simonstown) Chapmans Bay, Cape Peninsula (AB), *Lewis 473* (SAM); Muizenberg, *Pappe s.n.* (SAM 21121); Bergvleit farm, Ladies Mile, *Purcell s.n.* (SAM 90094); Cape Flats, near the German Church, Wynberg, *Kensit s.n.* (BOL 13419); Cape Flats, ¼ mi. SE of Retreat, *Pillans 8900* (BOL); Olifantsbosch, Cape Point (AD), *Lewis 1112* (SAM); Doornhoogte, Cape Flats (BA), *Ecklon & Zeyher Irid. 290* (78.11) (G, MO); sand dunes near Eerste Rivier, *Schlechter 9025* (B, BM, G, MO); flats near the Nuclear Institute, Faure, *Oliver 4059* (MO, STE); near Faure, *Boucher 3228* (PRE, STE).

3419 (Caledon) Kleinmond (AC), *Loubser 963* (NBG); Hermanus, W end of the town, *Goldblatt 675* (BOL); Die Mond, Voelklip, Hermanus, *S. Williams 527* (MO); Groot Hagelkraal, Haelkraal River area, NE of the farmstead (DA), *Oliver 6130* (PRE, STE).

3420 (Bredasdorp) De Hoop-Potberg Nature Reserve, Potberg farm (BC), *Burgers 1416* (STE); Bon-tebok Park, Bredasdorp (CA), *Compton 22185* (NBG).

47. *Geissorhiza exscapa* (Thunb.) Goldbl., comb. nov. *Gladiolus exscapus* Thunb., Prod. 2: 184. 1800, Skr. Naturhist.-Selsk. 6: 3, fig. 1. 1810. *Engysiphon exscapus* (Thunb.) Lewis, J. S. African Bot. 7: 23–24. 1941 (name applied to *G. confusus* Goldbl.). *Sphaerospora exscapa* (Thunb.) Klatt, Linnaea 32: 725. 1863, pro parte, nom. illeg. gen. illeg. hom. (name applied to several allied species). *Acidanthera exscapa* (Thunb.) Baker ex Bouche & Wittmack, Monatsschr. Vereines Beförd. Gartenbaues Königl. Preuss. Staaten 19: 15. 1876; Baker, J. Linn. Soc., Bot. 16: 160. 1878, in syn. of *A. tubulosa*; Foster, Contr. Gray Herb. 114: 44. 1936. TYPE: South Africa. Cape: origin unknown, *Thunberg s.n.* "*Gladiolus exscapus* α" (lectotype, Herb. Thunb. 1022 UPS, here designated); *Thunberg s.n.* "*Gladiolus exscapus* β" (syntype, Herb. Thunb. 1023 UPS). FIGURE 55.

Gladiolus thunbergii F. G. Dietrich, Nachtr. Vollst. Lex. Gärt. 3: 494. 1817, nom. superfl. pro *G. exscapus* Thunb.

Acidanthera tubulosa Baker, J. Linn. Soc., Bot. 16: 160. 1878, Handb. Irid. 186. 1892, Fl. Cap. 6: 132. 1896, pro parte (applied also to *G. confusus*). *Acidanthera tubulosa* N. E. Brown, Kew Bull. 1929: 137. 1929, hom. illeg. *Acidanthera picta* Foster, Contr. Gray Herb. 114: 43–44. TYPE: South Africa. Cape: without precise locality, Herb. Burman (lectotype, G, here designated).

Ixia tubulosa Burm. f. sensu Houtt., Nat. Hist. part 2, 12: 36–37, tab. 78, fig. 2. 1780.

Engysiphon pictus (Foster) Lewis non sensu Lewis, J.

S. African Bot. 7: 21. 1941, Fl. Cape Penins. 252. 1950 (applied to *G. bonae-spei*).

Engysiphon longitubus Lewis, J. S. African Bot. 7: 24. 1941. TYPE: South Africa. Cape: Warm Baths, Clanwilliam, *Leipoldt s.n.* (holotype, BOL 20840).

Plants 18–32 cm high. *Corm* globose, 10–15 mm diam., tunics brown, concentric, layers fragmenting irregularly, segments drawn into short points above. *Cataphyll* pale, membranous, apparently solitary. *Leaves* 3, linear or appearing nearly terete, sticky on the sheath and blade, often with adhering sand, the margins expanded into wings held at right angles to the blade and curving inward, the blade thus appearing nearly terete with 2 longitudinal grooves, the midrib not or barely raised, the lowermost leaf basal, largest, reaching to about the base of the spike, the second similar but shorter, the third becoming bract-like and partly sheathing, inserted on the mid part of the stem. *Stem* sometimes very short, often sheathed almost entirely by the leaves, flexed above the sheath of the second leaf and inclined to horizontal, also flexed towards the base of the spike, usually unbranched. *Spike* inclined to horizontal, (1–)3–9-flowered, flexuose; *outer bracts* (30–)45–65 mm long, herbaceous, the inner membranous, much shorter, to 20 mm long. *Flower* zygomorphic, the stamens and style declinate, the tepals cream to ivory with darker veins, reddish on the reverse, turning reddish on fading; *perianth tube* 4–8 cm long, usually well-exserted from, or occasionally reaching only to the apex of the bracts, curving near the throat; *tepals* 26–35 mm long, 4.5–6 mm wide, the outer wider, and shorter than the inner. *Filaments* unilateral and declinate, held above the lowermost tepal; *anthers* unilateral, horizontal, 6–7 mm long. *Ovary* 6–9 mm long, *style* declinate, curving below the filaments, dividing near the apex of the anthers, branches ca. 3 mm long, ultimately recurved. *Capsule* oblong-elliptic, to 20 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 7061).

Flowering time. September to October.

Distribution. Deep sandy soils along the west coast, from Blouberg near Cape Town in the south to near Hondeklipbaai in Namaqualand, also occasional in the mountains from Pakhuis Pass to the Nieuwoudtville Escarpment. Figure 55.

Although *Geissorhiza exscapa* was first described in 1800 (Thunberg, 1800), it has remained poorly understood. This was a result partly of the confusion of this species with several other taxa including *G. tenella*, *G. schinzii*, and

G. confusa, and then when the systematics of the alliance was revised by Lewis (1941) and these species were treated as distinct, the type material was not critically examined. Thus in Lewis' revision of *Engysiphon*, to which she assigned all of these species, *G. exscapa* was described as a new species, *E. longitubus*, while the combination *E. exscapus* was applied to the species here named *G. confusa*.

The type material of *Geissorhiza exscapa* consists of two sheets in the Thunberg Herbarium at Uppsala, which bear the annotations *Gladiolus exscapus* α (1022) and β (1023). The first sheet consists of five specimens of a species with a long perianth tube, 65–78 mm long, well-exserted from the long bracts, a very short, mostly underground stem and narrow, nearly terete leaves with winged margins and weakly developed midrib. The second sheet consists of fragments of a grass species and one *Geissorhiza* specimen, with similar long-tubed flowers, a robust leaf with raised and winged margins and poorly developed midrib and a well-developed above ground stem. The description and the specific epithet match closely the specimens on the first sheet, these in turn matching *Engysiphon longitubus* Lewis. The correct name for this species, now referred to *Geissorhiza*, must be *G. exscapa*. The species to which Lewis gave the name, having no synonym, is here described as a new species, *G. confusa*.

When first described, Thunberg's two line diagnosis mentioned only the ensiform and unribbed (enervosus) leaves and filiform tepal tube exceeding the spathes. The description, amplified later (Thunberg, 1810, 1818), and accompanied by an illustration, leaves no doubt about the identity of the species. While the description clearly applies to all the specimens on the first sheet, they may comprise more than one gathering, and accordingly a single specimen has been designated the lectotype.

The identity of *Acidanthera tubulosa*, a species at least in part, treated as synonymous with *G. exscapa* by Baker (1892, 1896) is in some doubt. *Acidanthera tubulosa* was based on the specimen that Houttuyn (1780) identified and figured as *Ixia tubulosa* Burm. f. Burman's *Ixia tubulosa*, was apparently based on four specimens, comprising three species (Brown, 1929). The description matches best the species of *Babiana*, of which there are two sheets, and *I. tubulosa* is today regarded as the basionym of *Babiana tubulosa* (Burm. f.) Ker (Lewis, 1959), and can be regarded

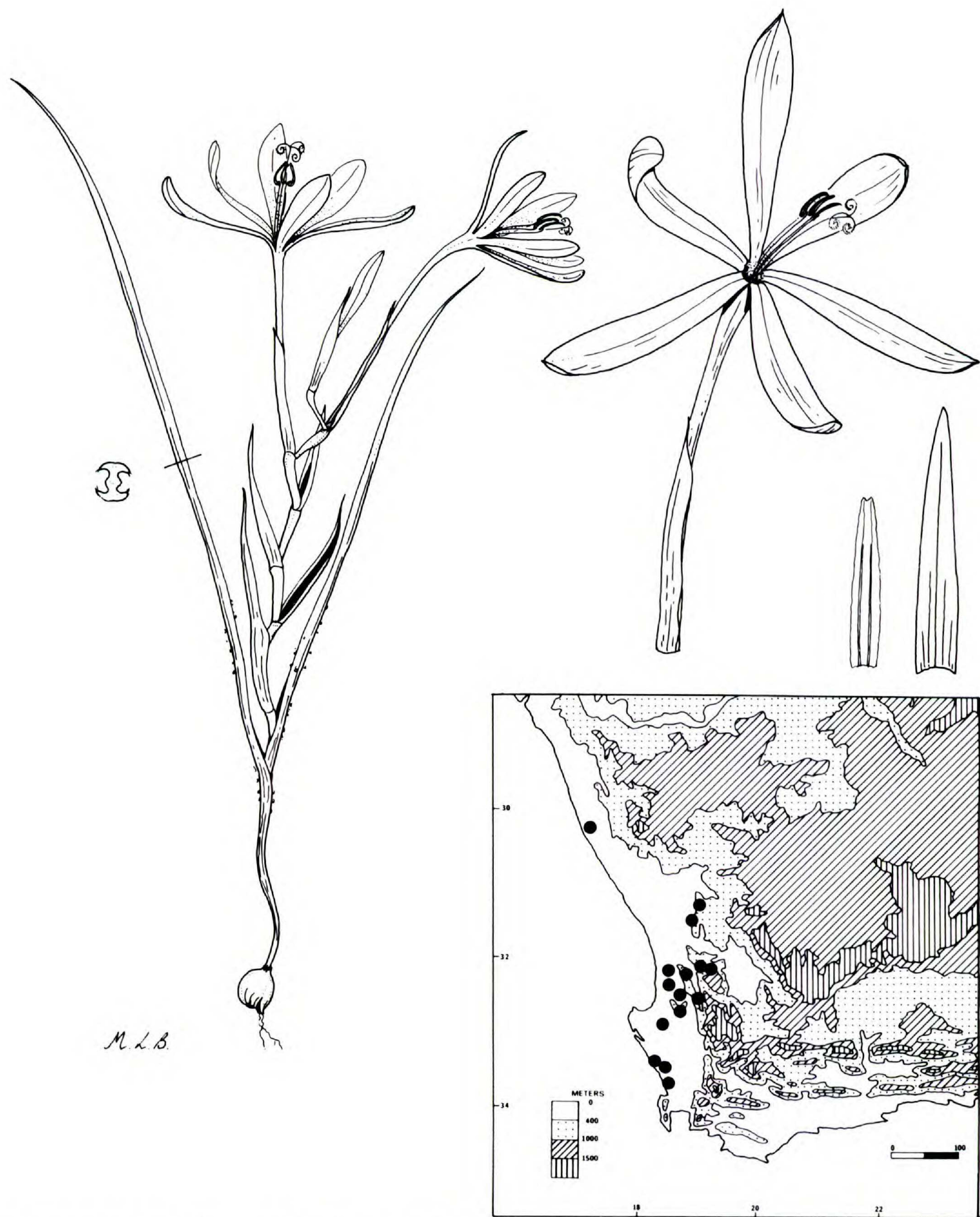


FIGURE 55. Morphology and distribution of *Geissorhiza exscapa*. Habit $\times 0.5$; flower and separated bracts life size (*Goldblatt 7061*, top of Vanrhyns Pass).

as having been effectively lectotypified by Brown (1929). Baker was aware that the Burman species was identified with *Babiana* and he cited it in the synonymy of *B. tubiflora* in the “Flora Capensis.” Thus his apparent combination *Acidanthera*

tubulosa (Houtt.) Baker clearly excludes the type of Burman’s *Ixia tubulosa* and *A. tubulosa* should be regarded rather as a new species dating from the time that the epithet was first used in *Acidanthera*. It is typified by the

figure published by Houttuyn and by the specimen on which the figure was based. The specimen in the Burman Herbarium is here designated as the lectotype.

This specimen has long bracts, 45–54 mm long, flowers with a tube reaching only to the apex of the bracts, tepals to 22 mm long, anthers 5–6 mm long and an incomplete leaf, clearly of the type with winged margins and poorly developed midrib. The identity of this plant is in doubt, as it does not match a specimen of any species exactly. However, it seems closest to *G. exscapa* and is here treated as a synonym of this species. The bracts and the perianth tube fall within the range recorded for this species (bracts normally 45–65 mm long, tube 40–80 mm long, typically but not always exerted) but the tepals, no longer than 22 mm are shorter than any recorded for *G. exscapa* in which they normally range from 26–35 mm long. The only other species that comes close to matching the specimen is *G. tenella* but this species has bracts and a tube only 20–40(–50) mm long, tepals 14–23 mm long, anthers 3–4.5 mm long, and a much narrower leaf than the one on the type specimen. Lewis identified *Acidanthera tubulosa* with *G. bonae-spei* (as *Engysiphon pictus*), largely on the basis of the perianth tube not being exerted from the bracts. The bracts and the tube of *A. tubulosa* are, however, far too long for *G. bonae-spei*, while the flowers are much too small.

Despite the historic confusion between *Geissorhiza exscapa* and *G. confusa*, they do not seem particularly closely related. The distinctive leaf of *G. exscapa* with its broadly winged margins and poorly developed midrib, suggests that the species is closely allied to *G. bonae-spei* and especially to the slender and long-tubed *G. tenella* [*Engysiphon rosea* (Schinz) Lewis]. *Geissorhiza tenella* has a narrower leaf, shorter bracts and perianth tube, and there is not normally any confusion between the two species. However, specimens from the south of the range of *Geissorhiza exscapa*, notably *Esterhuysen 34420A* from Blouberg and *Compton 9817* from Mamre road, seem to intergrade with longer tubed specimens of *G. tenella*. The two species can, however, usually be distinguished by careful attention to size differences in the flowers. The largest flowered specimens of *G. tenella*, such as *Esterhuysen 35084* from Riverlands, *Wolley Dod 3419* from Camp Ground and *Esterhuysen 16009* from Joostenberg, have perianth tubes 35–40 mm long

and tepals to 24 mm long and 4.5 mm wide. In contrast, the smallest flowered specimens of *G. exscapa* have a perianth tube at least 40 mm long and tepals 27 mm long by 5 mm wide.

Geissorhiza exscapa has its main range along the western Cape coast, where it extends from Blouberg, near Cape Town, to southern Namaqualand around Hondeklipbaai. It grows typically in deep alluvial coastal sands in sandveld vegetation with Cape taxa such as *Wiborgia* (Leguminosae) and *Wildenowia* (Restionaceae). It also occurs in similar habitats in the western Cape mountains between Pakhuis Pass and the Nieuwoudtville Escarpment where plants are generally taller and shorter tubed.

Several of the collections from the Nieuwoudtville Escarpment (*Strauss 60*, *Lewis 6114*, *6119*) stand out in having the bracts rather shorter than usual, these being in the 3–3.5 mm range, in fact matching the bracts of *G. confusa*. The leaves in these collections are, however, quite typical of *G. exscapa* of which these plants seem merely to represent a short bracted form. Collections from the Pakhuis Pass area, *Compton 9627* and *Esterhuysen 3186*, as well as *Grant 3449* from Piketberg, also differ in having the perianth tube very shortly exerted from the bracts, and this gives the specimens an unusual appearance. Again, the leaves are typical and there seems no reason to revise the determination. In the absence of leaves, these plants can hardly be distinguished from *G. confusa*, in which the tube may occasionally be up to 50 mm long.

Specimens examined. SOUTH AFRICA. CAPE: 3017 (Hondeklipbaai) sand dunes between Wallekraal and Hondeklipbaai (AD), *Goldblatt 4226* (K, MO, NBG).

3118 (Vanhynsdorp) top of Kobee Pass, ca. 15 mi. from Van Rhynsdorp (DA), *Strauss 60* (NBG); Nardouw Pass (DC), *Lewis s.n.* (BOL 22255).

3119 (Calvinia) Nieuwoudtville Escarpment between Meulsteenvlei and Clouds Kraal (AC), *Goldblatt 4332* (MO); top of Vanhyns Pass at Meulsteenvlei, *Goldblatt 7061* (MO); Arendskraal farm near Nieuwoudtville, *Lewis 6119* (NBG); Meulsteenvlei, Calvinia, *Lewis 6114* (NBG), *Snijman 49* (NBG); 21 mi. S of Nieuwoudtville, Lokenburg (CA), *Story 4349* (K).

3218 (Clanwilliam) between Leipoldtville and Elands Bay (AB-AD), *Zinn s.n.* (SAM 59829); Graafwater (BA), *Zinn s.n.* (SAM 59828); 3.5 mi. NE of Graafwater, *Acocks 19764* (PRE); mts. above Clanwilliam (BB), *Bayliss 6109* (MO); Kranzvlei, Clanwilliam, *Leipoldt 4430* (BOL, NBG); 9 mi. N of Hopefield (CD), *Salter 3905* (BOL); near Het Kruis (DA), *Barnard s.n.* (SAM 68436), *Stephens 8612* (K); sandy flats NW of Eendekuil, *Howes 194* (PRE); near Piketberg (DC), *H. Bolus s.n.* (BOL 22563); Piketberg, *Grant 3449* (MO, PRE), *Marloth 6580* (PRE).

3291 (Wuppertal) Pakhuis (AA), *Esterhuysen 3186* (BOL); Pakhuis Pass, *Compton 9627* (NBG), *Emdon 127* (STE); Warm Baths, Clanwilliam (CA), *Leipoldt s.n.* (BOL 20840).

3318 (Cape Town) near Hopefield (AB), *Garside 1631* (K), *Bachmann 855* (Z); Zonquasfontein ca. 8 km NW of the homestead, *Thompson 3512* (STE); Mamre road (CB), *Compton 9817* (NBG); Bokbaai, *van Rensburg 529* (PRE, STE), *557* (PRE); Blaauberg farm, inland from Blaauberg, in sandveld (CD), *Esterhuysen 3442A* (MO).

WITHOUT PRECISE LOCALITY: Cape of Good Hope (CBS), *Roxburgh s.n.* (BM).

SUBGENUS *GEISSORHIZA*

2. Subgenus *Geissorhiza*. TYPE: *G. obtusata* Ker.

Geissorhiza subgenus *Eugeissorhiza* Foster, Contr. Gray Herb. 135: 18. 1941, nom. illeg.

Corms with imbricate light to dark brown or blackish tunics, *leaves* lanceolate to ensiform or linear, blade plane, or with the margins and midrib and sometimes other veins thickened, or winged and ciliate-pubescent, *stem* smooth or ciliate-puberulous, *spike* few to several flowered, *bracts* herbaceous, often becoming dry above, ferrugineous in the upper half (sections *Ciliata* and *Planifolia*), *flowers* hypocrateriform, stellate or declinate, tube about as long as the bracts, or very short, stamens equal or unequal with one filament somewhat to much shorter than the other two.

Species. 34.

Distribution. Figure 18.

SECTION *INTERMEDIA*

8. Section *Intermedia* Goldbl., sect. nov. TYPE: *G. scillaris* A. Dietr.

Tunicae cormi plerumque pallide brunneae, foliis marginibus costisque incrassatis, caule glabro, spica pluriflora, bracteis supra siccis, floribus stellatis, tubo brevi, staminibus aequalibus.

Corm tunics usually light brown, *leaves* with thickened margins and midribs, *stem* smooth, *spike* several flowered, *bracts* dry and membranous above, *flowers* stellate, tube short, stamens equal.

48. *Geissorhiza similis* Goldbl., sp. nov. TYPE: South Africa. Cape: W slopes of Redhill, near the top, *Lewis 2493* (holotype, SAM; isotypes, PRE, STE). FIGURE 56.

Planta 12–25(–35) cm alta, tunica cormi imbricatis lignosis pallide brunneis, foliis 3, inferiore longissimo

basali 1–2 mm lato, marginibus costisque incrassatis quadrisulcatisque, superiore infra caulem vaginante, caule erecto, raro ramoso, spica florum (2–)3–8, floribus stellatis, albis vel cremeis, tubo 2.5–3 mm longo, tepalis 9–12 mm longis, antheris ca. 3 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants 12–25(–35) cm high. *Corm* more or less symmetric, globose, 8–11 mm diam., tunics imbricate, woody, light brown, incised below into triangular, acute to truncate teeth. *Cataphyll* solitary, membranous, usually sticky and covered with sand. *Leaves* 3 (rarely 2), erect to falcate, linear, 1–2 mm wide, the margins and midrib enlarged and with 2 grooves running the length of each surface, edges of margin and midrib evidently smooth but often minutely ciliate to hispid, the lowermost leaf longest, basal, reaching to about the base of the spike, occasionally longer than the stem, the second much shorter, basal or inserted on the lower part of the stem, the uppermost leaf inserted on the mid part of the stem, usually short and sheathing below, occasionally reduced and entirely sheathing and bract-like, sheath ribbed, the lower two leaves often sticky below especially on margins, and with sand adhering even when dry. *Stem* erect, rarely branched, bearing a single small leaf or leafy bract in the mid part. *Spike* (2–)3–8-flowered, somewhat flexuose; *bracts* herbaceous, hyaline above and sometimes red-flushed, 4.5–7 mm long, the inner shorter than the outer. *Flower* stellate, white to cream, tepals spreading when fully open, the outer flushed pink on the reverse; *perianth tube* 2.5–3 mm long, shorter than the bracts; *tepals* 9–12 mm long, obovate, 5–6 mm wide. *Filaments* 2–3 mm long, equal; *anthers* 2–3 mm long, yellow. *Ovary* 1.5–2 mm long, *style* dividing at the apex of the anthers, branches to 2 mm long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (*Goldblatt 7052*, s.n. no voucher, Bains Kloof).

Flowering time. Late August to October.

Distribution. From the southern Cape Peninsula and Hottentots Holland Mountains to Jonas Kop and Bains Kloof in the north, with an isolated record from the Cedarberg, in sandy mountain soil. Figure 56.

Geissorhiza similis resembles the apparently unrelated *G. hispidula* to such a degree in its leaves and flowers that if it had not been for the well-preserved corms of a few collections, notably *Thomas s.n.*, *Lewis 2493*, and *Barker 5911*, I would not have hesitated to regard specimens

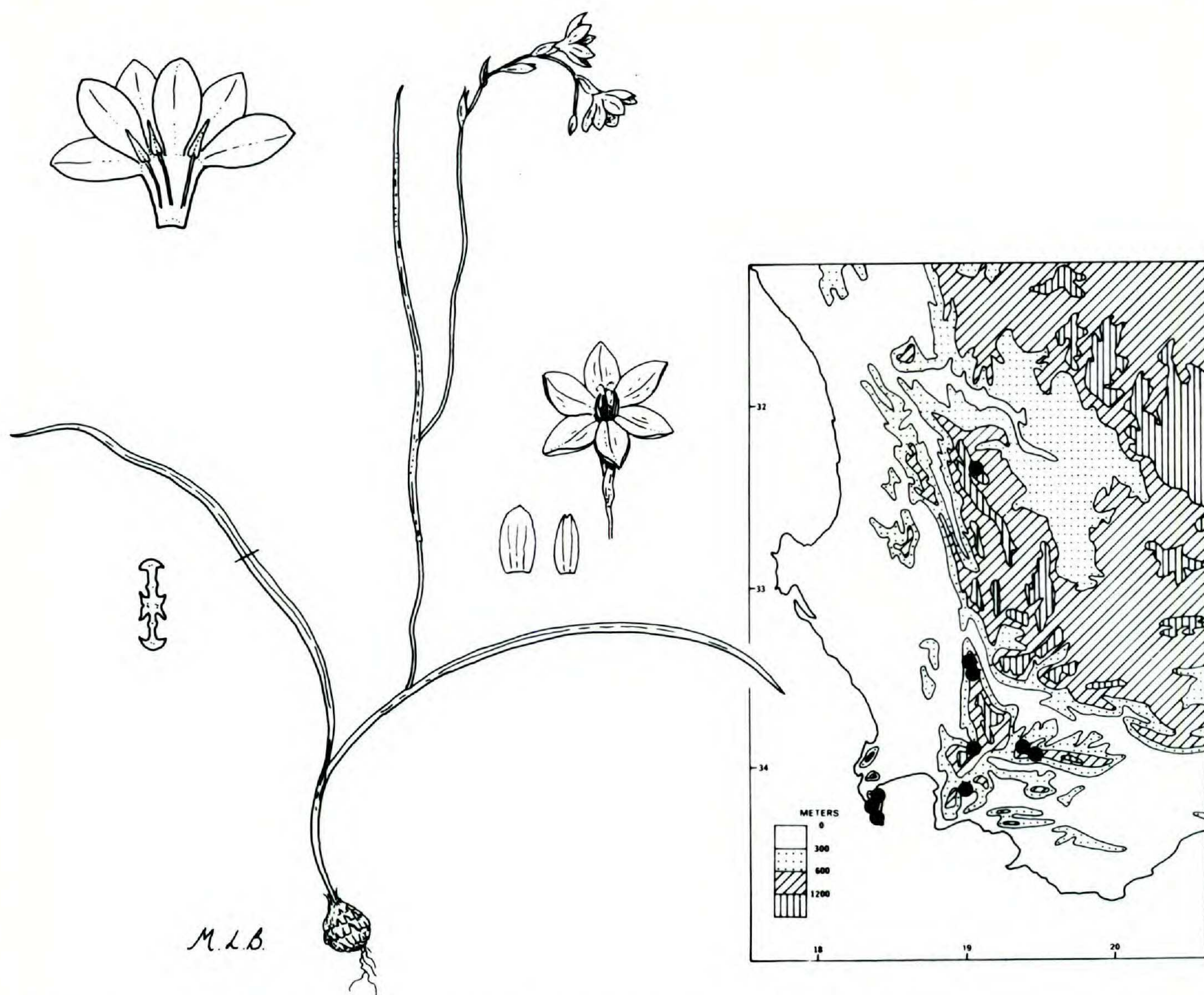


FIGURE 56. Morphology and distribution of *Geissorhiza similis*. Habit $\times 0.5$; intact flower life size; partial flower and gynoecium $\times 2$; leaf section much enlarged (Goldblatt 7052, mts. at Clovelly, Cape Peninsula).

of this species as no more than rather slender examples of *G. hispidula*. The corm tunics of *G. similis* are, however, clearly imbricate rather than concentric as in *G. hispidula*. This distinction is probably fundamental, and it suggests that these two species actually belong to different subgenera, imbricate corm tunics being a characteristic of subgenus *Geissorhiza*, while *G. hispidula* has concentric corm tunics typical of subgenus *Weichea*. The tunics of *G. similis* are unusual in subgenus *Geissorhiza* only being a light brown rather than blackish as in most species. In this respect they resemble those of *G. scillaris*, and it is to this species that it is most probably related. These two species have thus been placed in their own section, *Intermedia*.

A careful examination of *Geissorhiza similis* reveals several small ways in which it can be distinguished from *G. hispidula*. The leaves are softer in texture and only sticky below rather

than throughout, and the bracts are not at all sticky so that they are free of adhering sand. The flowers of *G. hispidula* are a different color, being cream to pale yellow and usually have relatively dark reddish markings on the reverse of the outer tepals, while *G. similis* has white- to cream-colored flowers often not or only very lightly marked on the reverse of the outer tepals.

Taller and more slender specimens of *Geissorhiza similis* can easily be confused with *G. umbrosa* in the absence of corms. The two species are in fact very similar, although *G. umbrosa* has somewhat larger flowers and narrower leaves and it never has ciliate to hispid margins. When corms are available, *G. similis*, with its woody to stiffly membranous imbricate tunics, can always be distinguished from *G. umbrosa* which has soft membranous to fibrous and concentric corm tunics.

The recorded distribution of *Geissorhiza sim-*

ilis is the southern Cape Peninsula and the mountains across the Cape Flats from the Hottentots Holland Mountains to Jonas Kop in the Rivier-sonderend Mountains and Bains Kloof some 80 km to the north. There is also an isolated record from the Cedarberg. The species is relatively inconspicuous and easily overlooked and it seems likely that it occurs elsewhere in the southwestern Cape. Its range is likely to be extended with further collecting in the mountainous areas to the north and east.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) South Cedarberg, path from base of Sneeuberg to the Maltese Cross, in marshy area after fire (CA), *Esterhuysen* 35669 (BOL, K, MO, PRE).

3319 (Worcester) Bains Kloof (CA), *Schelte* 4192 (BM, SAM), *Loubser* 476 (NBG), *Strey* s.n. (M); Baviaans Kloof, off Bains Kloof, *Leighton* 2158 (BOL, NBG); Upper Wellington Sneeuksop, foot of cliffs, *Esterhuysen* 21789 (BOL); French Hoek Pass, summit ridge of Middagkransberg (CC), *Boucher* 2390 (K, PRE, STE); French Hoek Forest Reserve, *Leighton* 281 (BOL); Jonaskop, 200–300 ft. below summit on E side (DC), *Esterhuysen* 35630 (BOL, MO); Jonaskop, among rocks below summit on N side, *Goldblatt* 6423 (K, MO, NBG, PRE, S).

3418 (Simonstown) Kalk Bay Mt. (AB), *Barker* 4223 (NBG), *Goldblatt* 3111 (MO); damp shaded SE-facing mt. slopes above Clovelly, *Goldblatt* 7052 (K, MO, NBG, PRE, S, WAG); plateau between Kalk Bay and Steenberg Peak, *Lewis* 4794 (PRE, SAM 57331); W slopes of Redhill, near top, *Lewis* 2493 (PRE, SAM 61718, STE); between Redhill and Klaasjagers, *Lewis* 2492 (SAM); Redhill, Simonstown, *Barker* 5911 (NBG, STE), *Taylor* 5244 (PRE, STE); Simons Bay, *Wright* 248 (GH, K, L); Rooihoogte, Cape Peninsula, *Leighton* 280 (BOL), *Compton* 13788 (NBG); Glencairn Mt., *Compton* 11583 (NBG); Cape Point Reserve (AD), *Thomas* s.n. (NBG 67496); Steenbras Mts., Rockview Dam site (BB), *Snijman* 564 (MO, NBG).

3419 (Caledon) Boschmans Kloof, Elgin (AA), *Stokoe* s.n. (SAM 60197).

49. *Geissorhiza scillaris* A. Dietr., Sp. Pl. 6th edition, 2: 587. 1833; Goldblatt, Nordic J. Bot. 3: 441. 1983. *Ixia scillaris* Thunb., Diss. de *Ixia* no. 14: 146. 1783, hom. illeg. non L. (1762). *Ixia ramosa* Ker, Bot. Mag. 17: sub. tab. 549. 1802, nom. nov. pro *I. scillaris* Thunb. *Ixia phalangioides* Roem. & Schult., Syst. Veg. 1: 385. 1817, nom. superfl. pro *Ixia ramosa* Ker, but intended as a nom. nov. pro *I. scillaris* Thunb. TYPE: South Africa. Cape: without precise locality, *Thunberg* s.n. [lectotype, Herb. Thunb. 992 UPS, pro parte, designated by Goldblatt (1983); isolectotype, S], the type material at UPS comprises a mixture of *G. scillaris* and *G. juncea*; *Thunberg* s.n. [syntypes, Herb.

Thunb. 992 UPS, pro parte, S = *G. juncea* (Link) A. Dietr., Herb. Thunb. 993 UPS = *G. imbricata* (de la Roche) Ker]. FIGURE 57.

Geissorhiza juncea var. *pallidiflora* (Schltr.) Foster sensu Foster, Contr. Gray Herb. 135: 23. 1941. As to most specimens cited but excl. type [= *G. juncea* (Link) A. Dietr.].

Plants slender, (12–)15–35 cm high. *Corm* globose, 8–12 cm diam., larger when old tunic layers numerous, tunics woody, rarely papyraceous, brown, imbricate, outer layers fragmenting regularly below into regular narrow truncate segments, drawn into bristles above. *Cataphyll* evidently solitary, often broken, sticky and with sand adhering. *Leaves* 2, sticky, often with adhering sand especially below, the lower leaf free from the base and erect to falcate, cruciform in section, with strongly raised margins and midrib and 4 broad grooves running the length of the leaf, the upper leaf sheathing almost entirely, enclosing the stem in the lower half or nearly to the base of the spike, the free apical part short, 1–3 cm long. *Stem* erect, flexed below the spike, with a greenish to white, membranous sheathing 7–12 mm long bract in the upper third, simple or rarely with a short branch in the axil of the stem bract. *Spike* 4–10(–20)-flowered; *bracts* green, becoming dry, transparent and pale or rarely brownish above, spreading in the upper part, 6–8 mm long, the inner shorter than the outer, 5–7 mm long. *Flower* stellate, white, bluish white or blue with a white center; *perianth tube* 1–1.5 mm long, infundibuliform; *tepals* ovoid, 8–9 mm long, 3–4 mm wide. *Filaments* 2–3 mm long, equal; *anthers* 2.5–3.5 mm, pollen creamy white. *Ovary* ca. 1.5 mm long, *style* 5–6 mm long, dividing at the apex of the anthers, the branches ca. 1 mm long, recurved. *Capsule* globose, 3–4 mm long, shorter than the bracts. *Chromosome number*, $2n = 26$ (*Goldblatt* 5245).

Flowering time. Mid-August to October (to December at high altitudes).

Distribution. Mountains of the western Cape from Elgin and Shaws Pass in the south to the northern Cedarberg, usually above 800 m. Figure 57.

Geissorhiza scillaris is to me a very distinct and isolated species, yet surprisingly since it was first collected by Thunberg in the 1770s has either been treated as conspecific with the superficially similar and well known *G. juncea* or regarded as an unnamed species. As pointed out by Lewis in unpublished notes with several Bolus Herbarium

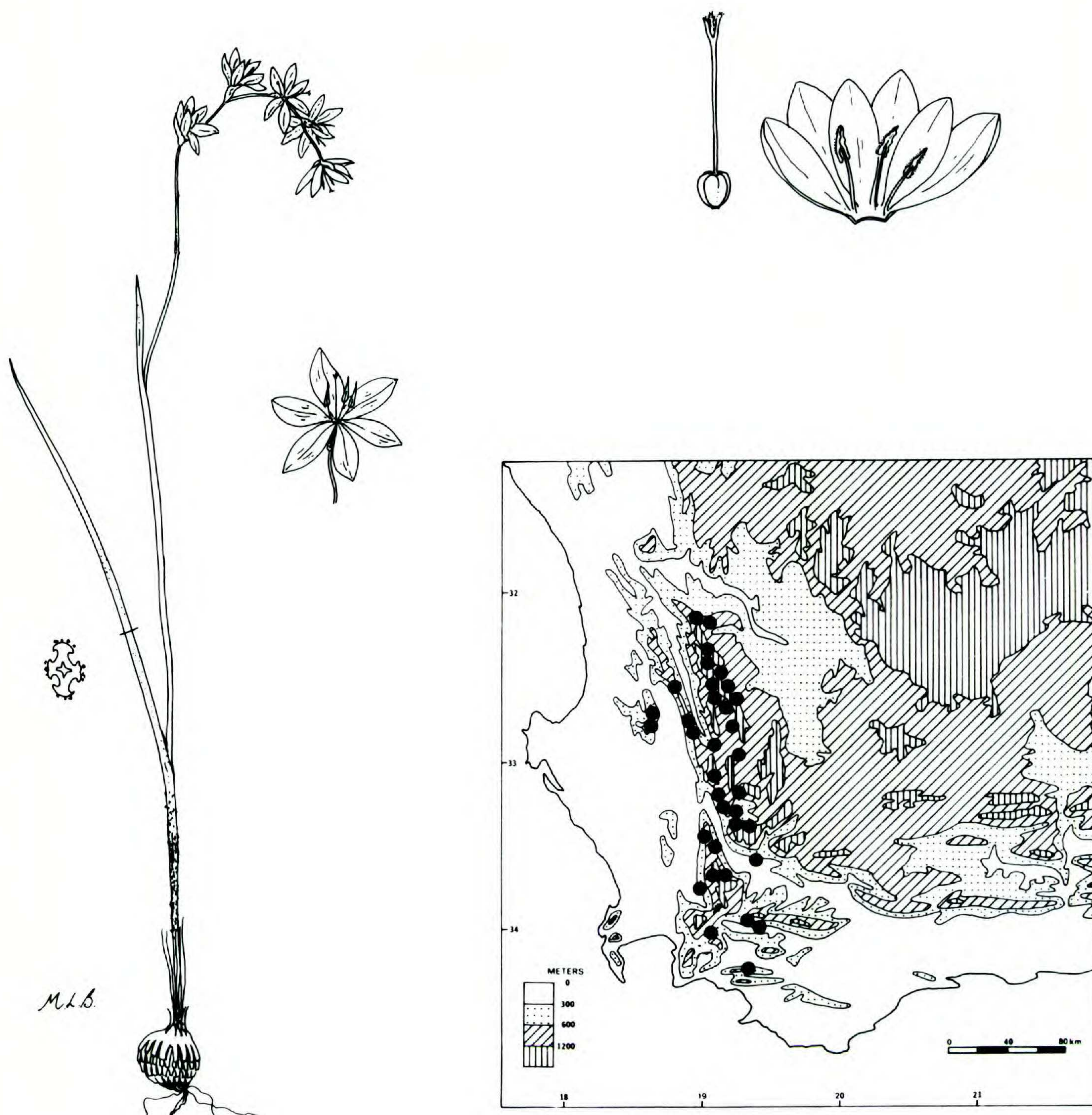


FIGURE 57. Morphology and distribution of *Geissorhiza scillaris*. Habit $\times 0.5$; intact flower life size; partial flower and gynoecium $\times 2$; leaf section much enlarged (Esterhuysen 35495, Zebrakop, Piketberg).

sheets, it differs from *G. juncea* in having only one free leaf instead of two, in having a second basal leaf sheathing most of the stem instead of a short third leaf only partly sheathing, and in having a different type of corm. Lewis could have added that *G. scillaris* is also distinctive in consistently having a short, membranous and sheathing bract on the upper part of the stem, a feature found rarely in *G. juncea*. The fact that *G. scillaris* was described, albeit from mixed material, as early as 1783 by Thunberg, as *Ixia scillaris* (an illegitimate homonym for *I. scillaris* L.)

has largely been overlooked. Typification of Thunberg's illegitimate homonym, *I. scillaris*, is complex owing to the fact that the type material consists of three different taxa. The arguments leading to the selection of a lectotype have been dealt with in a separate paper (Goldblatt, 1983).

The subsequent history of *Ixia scillaris* is complex. The species was renamed *I. ramosa* by Ker (1802c) (who must have chosen the epithet from the protologue and not from the type material which he did not see). The name did not get taken into general use, and Ker (1827) later placed *I.*

ramosa in the synonymy of *Geissorhiza imbricata*. Roemer and Schultes (1817) also renamed *I. scillaris*, calling it *I. phalangioides*, but the epithet is illegitimate and superfluous for *I. ramosa* Ker, cited in synonymy. Schultes (1822) distinguished *I. scillaris* from *I. juncea* as did Dietrich (1833), who transferred *I. scillaris* to *Geissorhiza*, but few other authors have. Baker (1892, 1896), in his important treatments of Iridaceae, ignored the species, and Foster (1941) placed *I. scillaris* Thunb. in the synonymy of *G. juncea*. Foster and probably Baker did not see Thunberg's collections. Brown, who examined the Thunberg Herbarium, also failed to distinguish *G. juncea* from *G. scillaris*.

Foster actually recognized the species here called *Geissorhiza scillaris* as *G. juncea* var. *pallidiflora* (Schltr.) Foster without realizing that the type material of *G. scillaris*, at least in part, matched his variety. *Geissorhiza juncea* var. *pallidiflora*, based on *G. pallidiflora* Schltr., is typified by *Schlechter* 9088, a collection that appears to differ in no significant way from *G. juncea*. The type collection of *G. pallidiflora* is, however, interesting in one respect, in that of the many plants of the gathering, two at least have a membranous stem bract, but this is probably coincidence and not indicative of any relationship with *G. scillaris*.

It is difficult to place *G. scillaris* with certainty to subgenus, but the limited number of known corms have tunics of the imbricate type, though unlike the typical tunics of subgenus *Geissorhiza*, species of which have heavy black tunics. The brown corm tunics of subgenus *G. scillaris* tend to accumulate more than is usual in subgenus *Geissorhiza* and over the years become rather distorted and broken. The species is here assigned to the ditypic section *Intermedia* of subgenus *Geissorhiza*, together with *G. similis*, which has corms with similar tunics. The two species are otherwise rather different and although probably not closely allied, they appear to belong to a single, perhaps very old line.

Geissorhiza scillaris is a fairly common species in the mountains of the western Cape, and it extends north from Shaws Pass and the Groenland Mountains at Elgin to Pakhuis Pass in the northern Cedarberg. It usually grows in open rocky places, in sandstone-derived soil, and usually at altitudes above 800 m. It may occasionally be found in damp places, but is clearly well adapted to dry stony situations. Most popula-

tions consist of plants with white flowers, but in the Cold Bokkeveld and Cedarberg there is an attractive blue-flowered form in which the flower center is white (*Goldblatt* 5072, *Esterhuysen* 3013, 20507, 13111).

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Mts. above The Rest, Pikeniers Kloof (DB), *Gillett* 3740 (BOL); Zebrakop, Piketberg, *Esterhuysen* 35495 (K, MO, NBG, PRE, S, WAG); Versveld Pass, Piketberg (DC), *Compton* 10991 (NGB).

3219 (Wuppertal) Heuningvlei (AA), *Stokoe* s.n. (SAM 55682), *Esterhuysen* 8061 (BOL); Koudeberg (Wuppertal), *Schlechter* 8775 (B, BM, BOL, BR, E, G, H, K, L, MO, PH, PRE, Z); Cedarberg, Middelberg (AC), *Lewis* s.n. (SAM 52416), *Kerfoot* 6115 (NGB), *Goldblatt* 4133 (MO); Uitkyk Pass, Cedarberg, *Barker* 267 (NGB); Elandskloof (CA), *Barker* 3793 (NGB), *Lewis* s.n. (BOL), *Goldblatt* 5245 (K, MO); Buffelshoek Pass, Middelberg, *Thompson* 2948 (PRE, STE); Top of Buffelsberg Pass, Elandskloof road, *Goldblatt* 2752 (MO, WAG); Middelberg, Elandskloof, *Hafstrom & Acocks* 299 (PRE, S); Crystal Pool hut, *Pocock* 674 (STE); Sneeuberg, summit, *Taylor* 6152 (PRE, STE); road to Krom River farm (CB), *Goldblatt* 5672 (K, MO, NBG, NSW, PRE, S, US, WAG); Kromme River, rocky ridge, *Esterhuysen* 20507 (BOL, PRE); Krom River farm, sandy flats, *Goldblatt* 5670 (MO); top of Dasklip Pass (CC), *Lewis* 6217 (NGB); Waboomsrievier, Cold Bokkeveld, *Hanekom* 631 (K, PRE); Cold Bokkeveld, near De Keur (CD), *Lewis* 2504 (BOL, K); Porterville Mts., NW end of Zuurvlaakte, *Thompson* 1476 (STE).

3318 (Cape Town) Klein Drakenstein (DD), *DuPlessis* s.n. (STE).

3319 (Worcester) Visgat (AA), *Stokoe* s.n. (SAM 63132); Winterhoeksberg, *Ecklon & Zeyher* Irid. 227 (72.11) (B, FI, G, MO); Great Winterhoek, *Marloth* 2337 (PRE); Saron, Tulbagh, *Andrag* s.n. (STE 19780); Gydo Pass (AB), *Leighton* s.n. (BOL), *Compton* 16229 (NGB); Gydouw, *Leipoldt* 3812 (BOL); top of the Witsenberg, near Steendal (AC), *H. Bolus* s.n. (BOL 5744, K); slopes of the Witsenberg, *Phillips* 1876 (SAM); Slab Peak, 4,000 ft., Michells Pass (AD), *Esterhuysen* 6163 (BOL); Ceres, *Acocks* 1809 (S), *Rogers* 28733 (Z); Eselfontein, Ceres, *Esterhuysen* 20362 (BOL, PRE); flats at head of Rooikloof, above Eselfontein, *Oliver* 5089 (PRE, STE); flats NW of Prince Alfreds Hamlet, *Oliver* 5016 (K, MO, PRE, STE); Mts. in Hex River Valley (?BC), *Tyson* 722 (BOL, SAM); Wellington (CA), *Grant* 2391 (BOL, BR, MO); Wolwehoek Forest Reserve, Bains Kloof, *Barker* 4336 (NGB); Bains Kloof, *Compton* 18266 (NGB); Mias Poort, above Du Toits Kloof, *Esterhuysen* 35517 (BOL, MO, US, WAG); slopes at N end of Du Toits Kloof, *Esterhuysen* 18912 (BOL, PRE); Molenaar's Peak, Du Toits Kloof, *Stokoe* s.n. (SAM 59845); Breede River flats near Worcester (CB), *Goldblatt* 6980 (MO, PRE).

3419 (Caledon) Vijoens Pass (AA), *Werdemann & Oberdieck* 395 (B, PRE); stony flats S of Villiersdorp at Theewater farms turnoff (AB), *Goldblatt* 4014 (MO, PRE); hillside N of Theewater Kloof, above dam, *Goldblatt* 4734 (MO); top of Shaws Pass, recently burned (AD), *Marsh* 1432 (PRE, STE).

WITHOUT PRECISE LOCALITY: *Thunberg s.n.* ("*Ixia scillaris* α ") (Herb. Thunb. 992 in part, S, UPS; Herb. Burman s.n., G).

SECTION GEISSORHIZA

9. Section *Geissorhiza*. TYPE: *G. obtusata* Ker.

Geissorhiza section *Rochea* Baker, J. Linn. Soc., Bot. 16: 93. 1878, nom. illeg. superfl.

Geissorhiza subsection *Ventricosae* Foster, Contr. Gray Herb. 135: 27. 1941. TYPE: *G. imbricata* (de la Roche) Ker, nom. illeg. superfl.

Corm tunics hard and woody, *stems* smooth, *leaves* with the margins and midrib and often other veins strongly thickened, ensiform to linear, or terete, *bracts* herbaceous below, becoming dry above, *flowers* stellate to hypocrateriform, actinomorphic or zygomorphic and declinate, the tube short or reaching to the apex of the bracts, stamens equal or unequal.

Species. 10.

50. *Geissorhiza imbricata* (de la Roche) Ker, Ann. Bot. (König & Sims) 1: 224. 1804; Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 72. 1896; Foster, Contr. Gray Herb. 135: 37. 1941, pro parte excl. var. *brehmii*; Lewis, Fl. Cape Penins. 255. 1950. *Ixia imbricata* de la Roche, Descr. Pl. Aliq. Nov. 17. 1766. TYPE: South Africa. Cape: Cape Peninsula, Lakeside, *Salter 7034* [neotype, BOL, designated by Goldblatt & Barnard (1970)]. FIGURE 58.

(For additional synonyms see under the subspecies).

Plants 6–25(–30) cm high. *Corm* 5–10 mm diam., globose, tunics blackish, imbricate, the outer layers accumulating above, and regularly notched below into segments. *Cataphyll* single, membranous, often lacking in dry material. *Leaves* 3, reaching from about middle to apex of spike, sometimes longer, ribbed with (2–)4 to several longitudinal grooves running the length of the leaf, the lower two basal, (linear to) ensiform, (1–)2–6(–10) mm wide, the third leaf largest, inserted on the stem near the base or in the lower part and sheathing below for half its length, the sheath strongly ribbed and inflated. *Stem* erect, simple or 1-branched, flexed above the leaf sheath. *Spike* (2–)6–8(–14)-flowered, flexed at the base and flexuose; *bracts* herbaceous below, often becoming dry and membranous above at flow-

ering time, (6–)8–12(–15) mm long, sometimes red above, the inner narrower than the outer. *Flower* stellate to shallowly cupped, white to cream or pale yellow, usually red on the reverse of the outer tepals, sometimes dark in the center; *perianth tube* 2–8 mm long, enclosed to slightly exerted from the bracts; *tepals* (9–)11–25(–30) mm long, obovate, (4.5–)5.5–12 mm wide, obtuse. *Filaments* equal, (3–)4–8(–10) mm long. *anthers* (3–)4–7 mm long, yellow. *Ovary* 2–3.5 mm long, style dividing near the apex of the anthers, branches 3–4 mm long, recurved. *Capsule* oblong-globose, to 10 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 165).

Flowering time. (August to) September to October.

Distribution. Southwestern Cape, from Bredasdorp north to the Olifants River Valley; mainly on damp poorly drained flats. Figure 58.

As treated here, *Geissorhiza imbricata* is one of the more variable species in the genus. It includes no less than three species recognized by Foster (1941) in his monograph of the genus: *G. wrightii*, *G. rubicunda*, and *G. bicolor* (including var. *macowanii*), as well as *G. sulphurea* var. *arenicola*.

The main forms or races of *Geissorhiza imbricata* are:

1. A short-tubed (2–4 mm) form, usually fairly low growing, with small, white to cream flowers that was once common on the Cape Peninsula and adjacent Cape Flats (*G. sabulosa*, *G. imbricata* sensu Baker and sensu Lewis).

2. A very robust form with a longer tube (3.5–6 mm) and with medium-sized flowers and sometimes very broad leaves (*G. wrightii*; *G. imbricata*, at least as to type).

3. A medium- to long-tubed form (5–8 mm) with large cream to pale yellow flowers and narrow to moderately broad leaves (*G. rubicunda*, *G. obtusata*).

4. A form similar to the previous but with a dark throat and often dark tube to the flower (*G. bicolor*).

It would seem convenient to give taxonomic recognition to all four forms or races as did Foster, but the existence of many intermediates, collected since Foster's monograph was published makes a revised treatment necessary. Lewis, in her treatment of *Geissorhiza* in the "Flora of the Cape Peninsula" (Lewis, 1950) maintained both the short-tubed form (as *G. imbricata*) and the

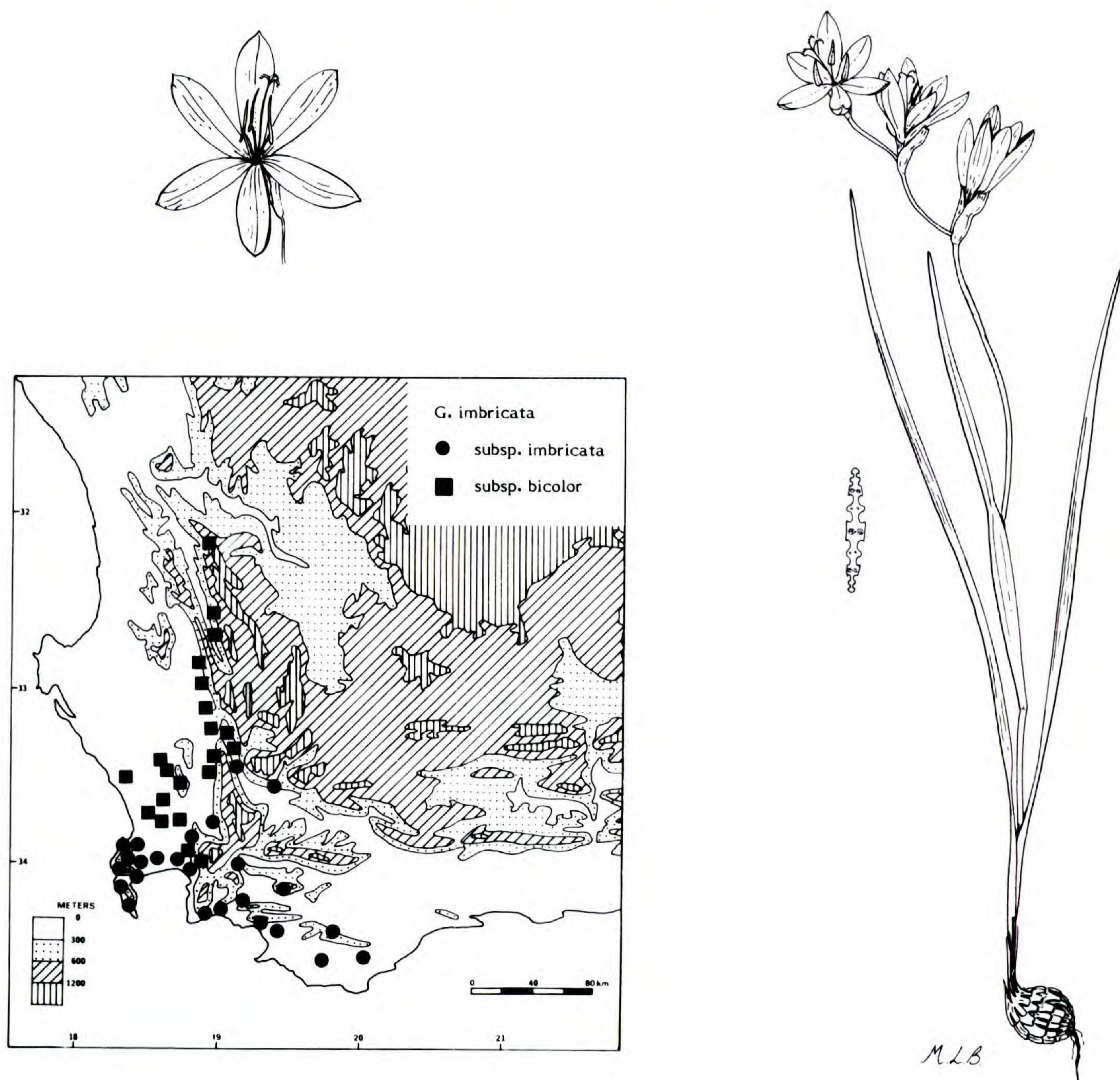


FIGURE 58. Morphology of *Geissorhiza imbricata* subspecies *imbricata* and the distribution of the two subspecies of *G. imbricata*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt s.n.* no voucher, Kirstenbosch).

robust and long-tubed *G. wrightii*, the only two forms occurring here, and most specimens on the Peninsula can readily be assigned to one of these. However, to the east in the Caledon and Bredasdorp districts a range of intermediates occur which I find impossible to assign with confidence to either of these taxa. The only solution seems to be to treat these as one taxon, which has in common small- to medium-sized flowers with a short to moderately long perianth tube. This taxon has a distinct southern distribution from the Cape Peninsula east to Bredasdorp.

It has also become impossible to continue to regard the cream- to pale yellow-flowered longer

tubed forms with self-colored flowers as distinct from those with dark markings in the throat and tube. The difference here seems solely to be one of coloration and there are populations of plants with and without the dark color in the throat and tube.

However, at present it does seem useful to formally recognize this larger, cream- to yellow-flowered form with a generally longer perianth tube as a distinct taxon. The presence of intermediates between this and the shorter tubed, white-flowered form in the Worcester and Tulbagh districts that cannot be assigned with confidence to either form suggests that subspecific

status may be most appropriate. The cream- to yellow-flowered form is thus treated as *Geissorhiza imbricata* subsp. *bicolor* (Thunb.) Goldbl.

KEY TO THE SUBSPECIES OF *GEISSORHIZA IMBRICATA*

- 1a. Flowers white to cream (often red on the reverse of the outer tepals), without a dark center; perianth tube 2–4(–6) mm long; tepals 9–15(–17) mm long subsp. *imbricata*
- 1b. Flowers cream to pale yellow (sometimes red on the reverse of the outer tepals), occasionally with a dark center; perianth tube (4–)5–8 mm long; tepals (16–)20–30 mm long subsp. *bicolor*

50A. Subsp. *imbricata*. FIGURE 58.

Ixia scillaris Thunb., Diss. de *Ixia* no. 14. 1783, pro parte, hom. illeg. non L., excl. lectotype (Goldblatt, 1982).

Geissorhiza sabulosa Klatt, Trans. S. African Philos. Soc. 3: 203. 1885. TYPE: South Africa. Cape: near Camps Bay, *Templeman sub Macowan* 2273 (lectotype, S, here designated; isoelectotypes, K, SAM).

Geissorhiza wrightii Baker, J. Bot. n.s. 5: 238. 1876, Fl. Cap. 6: 69. 1896; Foster, Contr. Gray Herb. 135: 35–36. 1941; Lewis, Fl. Cape Penins. 255. 1950. TYPE: South Africa. Cape: Simons Bay, *Wright* 243 [lectotype, K, designated by Foster (1941: 36); isoelectotypes, G, L].

Geissorhiza sulphurea var. *arenicola* Foster, Contr. Gray Herb. 135: 37. 1941. TYPE: South Africa. Cape: Ceres Road (Wolseley), *Schlechter* 8992 (holotype, B; isotypes, BM, BOL, BR, E, G, H, K, L, MO, PRE, S, Z).

Geissorhiza arenaria Ecklon ms. (*Ecklon* 1597, 313).

Plants (6–)10–20(–30) cm high. *Leaves* (1–)2–5(–10) mm wide. *Spike* (2–)6–8(–14)-flowered, flexed at the base and flexuose; *bracts* (6–)8–11 mm long. *Flower* stellate, white to cream, usually red on the reverse of the outer tepals; *perianth tube* 2–4(–6) mm long, enclosed in the bracts; *tepals* (9–)11–15(–17) mm long, obovate, (4.5–)5.5–7 mm wide, obtuse. *Filaments* (3–)4–5 mm long; *anthers* (3–)4–5 mm long, yellow. *Ovary* 2–3 mm long. *Capsule* oblong-globose, to 10 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 165).

Flowering time. (August to) September to October.

Distribution. Cape Peninsula eastwards to the Caledon and Bredasdorp districts, and local in the Worcester district north to near Wolseley. Figure 58.

Geissorhiza wrightii was described by Baker in 1876 and although it has remained poorly understood, it has been consistently recognized ever

since (Baker, 1896; Foster, 1941; Lewis, 1950). Foster actually saw little material of the species and was in some doubt about its status (Foster, 1941: 36) but he realized that it belonged to the “*imbricata* group.” Lewis, who had a considerable field knowledge of Iridaceae, stated in “Flora of the Cape Peninsula” that it was very like *G. imbricata* but larger and more robust and with a longer perianth tube (Lewis, 1950). The key distinction she made was that the leaves of *G. imbricata* were 1–5 mm wide with the blade of the sheathing leaf about as long as the sheath, while the tepals were 9–20 mm long and the tube 1–2 mm long. In contrast, the leaves of *G. wrightii* were 5–8 mm wide with the blade of the sheathing leaf usually much longer than the sheath, while the tepals were 16–20 mm long and the tube 3–5 mm long.

The leaf blade versus the sheath distinction is poor and there are several collections in which specimens have blades either larger or shorter than the sheath (*Goldblatt* 6189, *Page s.n.*) while several narrow-leaved specimens have a blade much longer than the sheath (*Zeyher* 1597). Moreover, a few of the specimens determined by Lewis as *G. wrightii* have leaves less than 5 mm wide. It seems that like many species of the genus, *Geissorhiza imbricata* can be very variable as regards height; leaf width; and length, number, and size of the flowers. Accordingly, *G. wrightii* seems better regarded as merely robust *G. imbricata* subsp. *imbricata*, possibly genetically distinct, but equally likely, simply large due to good growing conditions. It is here regarded as taxonomically identical with *G. imbricata* and the less robust *G. sabulosa*.

Geissorhiza imbricata subsp. *imbricata* has a southern distribution from the Cape Peninsula and Cape Flats to Bredasdorp. To the north, it is replaced by the larger and cream- to yellow-flowered subsp. *bicolor* which grows in similar wet to semi-marshy places. In the Worcester district and around Stellenbosch where the two subspecies meet, it is often difficult to assign specimens with confidence to either and some populations seem completely intermediate between the two in some or all their characteristics. The differences between the two subspecies are dealt with in more detail under subsp. *bicolor*.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) foot of Table Mt. near Kirstenbosch (CD), *H. Bolus* 4710 (BM, BOL, K); foot of Table Mt., *MacOwan s.n. Herb. Norm. Austr. Afr.* 258 (B, BM, G, GH, K); slopes near Blinkwater, *Levyyns s.n.* (CT);

Camps Bay, *MacOwan* 2273 (K, S, SAM), *Cassidy* 287 (CT, SAM), *Lavranos* 10993 (MO); above Camps Bay, *Wolley Dod* 2767 (BOL, K), *Lewis* 1213 (SAM), *Barker* 3850 (NBG); Raapenberg, Mowbray, *Guthrie* s.n. (CT); Camp Ground, *Salter* 9640 (BM); Kenilworth, *L. Bolus* s.n. (BOL 13944); Kenilworth Race Course, *Barker* 4793 (NBG), 4114 (NBG), *Lewis* 4793 (SAM), *Levy* s.n. (CT 5889); Claremont, *Page* s.n. (BOL); Wynberg, damp fields, *H. Bolus* s.n. (BOL 31876); boggy ground, Fernwood, *Pillans* 10640 (G, MO); Maitland flats, near cemetery, *Wolley Dod* 2888 (BM, BOL, K); Stellenbosch flats (DD), *Strey* s.n. (M), *Garside* 87 (K), 1049 (K).

3319 (Worcester) Ceres Road (Wolseley) (AC), *Schlechter* 8992 (B, BM, BOL, E, G, H, K, L, MO, PRE, S, Z); Brandwacht, Worcester (CB), *Esterhuysen* 8199 (BOL); Klein Drakenstein (CC), *Du Plessis* s.n. (STE 19731).

3418 (Simonstown) Schusterskraal vlei (AB), *Barker* 3888 (BOL, NBG); marsh at Lakeside Station, *Salter* 7034 (BOL); Modderdam, *Salter* 8689 (BOL, CT, K, SAM); Constantiaberg, *Compton* 15142 (NBG); lower slopes of Schoorsteenkop, Hout Bay, *Acocks* 692 (PRE); Orange Kloof, in swamp, *Wolley Dod* 3454 (BM, BOL, K); Three Beacons, Bergvliet flats, *Purcell* s.n. (MO, SAM 93340); Hout Bay, *Bond* 1227 (NBG), *Compton* 11295 (NBG); Constantia Nek, under pines, *Goldblatt* 423 (BOL); Fish Hoek flats, *Salter* 7397 (SAM); between Witsands and Redhill, *Lewis* 1201 (BOL, SAM); Cape Flats (BA), *Zeyher* s.n. (SAM 20858), *Zeyher* 1597 (B, BM, BOL, G, K, SAM, W, Z), *Pappe* s.n. (BM, SAM 20871), *Ecklon* 313 (E, K, M, MO, P, S, Z), *Moss* 4307 (Z), 4309 (BM); Cape Flats near the salt pans, *Bowie* 12 (BM); near Sir Lowrys Pass Station (BB), *Diels* 1252 (B); Faure, marshy ground, *van Niekerk* 276 (BOL); Faure, *Barker* 1824 (NBG), 2987 (NBG); Bettys Bay, wet soil (BD), *Ebersohn* 358 (NBG).

3419 (Caledon) flats E of Viljoens Pass (AA), *Davis & Stokoe* s.n. (SAM 61719); Zwarteberg, Caledon (AB), *Templeman sub MacOwan* 2611 (BOL, S, SAM); commonage at the foot of the Zwartberg, *Guthrie* s.n. (BOL 16919); wet area on Kleinmond road just S of Hermanus turnoff (AC), *Goldblatt* 2989 (MO, PRE, WAG); Karwyderskraal, between Bot River and Hawston, *Lewis* 5289 (NBG); Fernkloof Nature Reserve, Hermanus (AD), *Orchard* 307 (BR, E, K, MO, WAG); Hermanus-Stanford road, wet recently burned ground, *Gillett* 4166 (BOL), 4177 (BOL, K); kloof SW of Napier (BC), *Goldblatt* 6189 (MO, NBG, PRE, S, US, WAG); wet flats near Franskraal (CB), *Goldblatt* 7098 (MO, NBG, PRE); boggy ground near Elim (DA), *Muir* 5019 (NBG); near The Poort, Bredasdorp (DB), *Barker* 4594 (NBG), *Acocks* 1526 (S).

WITHOUT PRECISE LOCALITY: *Thunberg* s.n. (S "Herb. Montin," Herb. Thunb. 993 UPS), Herb. Burman s.n. (G), *Oldenburg* 45 (BM), 629 "*Ixia virginea*" (BM).

50B. Subsp. *bicolor* (Thunb.) Goldbl., comb. et stat. nov. *Ixia bicolor* Thunb., Phytogr. Blätt. 1: 3. 1803. *Geissorhiza bicolor* (Thunb.) N. E. Brown, J. Linn. Soc., Bot. 48: 44. 1928; Foster, Contr. Gray Herb. 135: 32–33. 1941. TYPE: South Africa. Cape: without precise locality, *Thunberg* s.n. "*Ixia bicolor* α" [lec-

totype, Herb. Thunb. 921 UPS, effectively designated by Brown (1928)]; "*Ixia bicolor* β" (syntype, Herb. Thunb. 922 UPS).

Geissorhiza obtusata Soland. ex Ker, Bot. Mag. 18: tab. 672. 1803. *Geissorhiza imbricata* var. *obtusata* (Ker) Baker, Fl. Cap. 6: 73. 1896. TYPE: South Africa. Cape: cultivated in England (originally collected by Niven) (illustration in Bot. Mag. tab. 672. 1803).

Geissorhiza imbricata var. *concolor* Baker, Fl. Cap. 6: 72. 1896; Foster, Contr. Gray Herb. 135: 38. 1941. TYPE: South Africa. Cape: near Somerset West, *H. Bolus* 5567 [lectotype, K, designated by Foster (1941); isoelectotype, BOL]; Somerset West, *Ecklon & Zeyher Irid.* 111 (syntypes, B, G).

Geissorhiza rubicunda Foster, Contr. Gray Herb. 135: 35. 1941. TYPE: South Africa. Cape: Michells Pass, *Schlechter* 8931 (holotype, B; isotypes, BM, BOL, BR, E, G, H, K, L, MO, P, PH, S, Z).

Geissorhiza bicolor var. *macowanii* Foster, Contr. Gray Herb. 135: 33. 1941. TYPE: South Africa. Cape: near Malmesbury, *MacOwan* s.n. Herb. Norm. Austr. Afr. 1568 (holotype, G; isotypes, B, G, K, Z).

Geissorhiza aurea Ecklon, Topogr. Verz., Pflanzen-samml. Ecklon 21. 1827 et ms. (*Ecklon & Zeyher Irid.* 211).

Plants 6–25 cm high. *Leaves* (1–)3–6(–9) mm wide. *Spike* 2–6(–9)-flowered, flexuose; *bracts* 10–12(–15) mm long. *Flower* somewhat cupped, cream to pale yellow, often red to purple-flushed on the reverse of the outer tepals, occasionally dark colored around the throat and then the tube usually also dark, rarely pale; *perianth tube* (4–)5–8 mm long, infundibuliform, usually slightly shorter than, or reaching the apex of the bracts, rarely exerted from the bracts; *tepals* (16–)20–30 mm long, obovate, 10–12 mm wide, obtuse. *Filaments* 7–10 mm long; *anthers* 5–7 mm long. *Ovary* 2.5–3.5 mm long. *Capsule* oblong to globose, 6–8 mm long. *Chromosome number*, unknown.

Flowering time. September to early October.

Distribution. Wet, usually sandy flats from False Bay north to Porterville, and in the Olifants River Valley. Figure 58.

Subspecies *bicolor* includes plants with pure yellow flowers as well as those with a dark center. Populations which have flowers with a dark center correspond closely to the type collection of *Geissorhiza bicolor* and are relatively rare, having been recorded from the Stellenbosch, Paarl, and Malmesbury districts, i.e., the south central part of the range of the subspecies. As far as I can tell all of the collections differ in no other character but the dark central color of the flower,

from the species known as *G. rubicunda* Foster. This was poorly known when first described but plants matching the type have now been collected at many sites in the Tulbagh and Porterville districts as well as in the Olifants River Valley to the north.

Collections matching *Geissorhiza bicolor* and *G. rubicunda* share the following significant features: a large pale yellow to cream, actinomorphic flower with tepals (16–)20–30 mm long; a relatively long perianth tube (4–)5–8 mm long, reaching nearly to the apex of or slightly exceeding the bracts; three usually fairly broad, several ribbed leaves; and spikes of up to 9, but usually 3–5 flowers. *Geissorhiza imbricata* subsp. *imbricata* typically has smaller white to cream flowers, with tepals 12–17 mm long, a short perianth tube 2.5–4(–6) mm long, not reaching the apex of the bracts, and fairly dense spikes of up to 12, but usually 6–8 flowers. The differences in flower size, color and, in particular, length of the perianth tube make confusion between most collections of these two subspecies unlikely.

Geissorhiza obtusata, Ker's "yellow flowered tile root," is included here in synonymy of subsp. *bicolor* as it seems to match almost perfectly *G. rubicunda*. The only type material known is the painting (tab. 672) in the "Botanical Magazine," the flowers of which are today either white (perhaps faded) or yellow in different copies of the volume. Baker (1896) treated this species as a variety of the related *G. imbricata*. Also included here in subsp. *bicolor* is *G. imbricata* var. *concolor* Baker (syn. *G. aurea* Ecklon nom. nud.) a distinct form from the southern Cape Flats. It has relatively broad and unusually obtuse leaves and self-colored flowers even lacking the usual red flush on the reverse of the tepals. *Geissorhiza bicolor* var. *macowanii* is apparently a name that Foster applied to a form with 3–4 flowers per spike and longer leaves than the two other collections which he assigned to *G. bicolor*, and it too is placed in synonymy.

Subspecies *bicolor* is closely related to the southwestern Cape species *G. brehmii* (syn. *G. teretifolia*), and the two can be distinguished only in their vegetative characteristics. *Geissorhiza brehmii* is a semi-aquatic species with terete, somewhat succulent or inflated leaves which if sectioned or viewed carefully with a lens can be seen to have four narrow longitudinal grooves running the length of the blade. Often its lowermost leaf is much reduced, vestigial, or even absent while the uppermost leaf is largest and

ribbed on the inflated sheath and also occasionally on the free upper part. Such specimens are especially difficult to separate from narrow-leaved individuals of subsp. *bicolor*. The white to creamy yellow flowers of *G. brehmii* also occasionally have a dark center. The differences between subsp. *bicolor* and *G. brehmii* are consistent and it seems useful to continue to recognize the latter as a distinct species.

Geissorhiza imbricata subsp. *bicolor* is also sometimes confused with *G. purpureolutea*. This species has narrow two-grooved leaves, usually ca. 15 mm wide and a smaller flower with tepals 10–17(–22) mm long and a short perianth tube, 2–4 mm long. The plants are also usually short, 6–12 cm high, although they may reach 17 mm. The two species grow in the same habitat and occasionally close to one another.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Pakhuis Mt., Clanwilliam (BB), *MacOwan s.n. in Herb. Norm. Austr. Afr. 1969* (B, BM, G, GH, K, S, SAM, Z), *MacOwan 3328* (S, SAM). 3219 (Wuppertal) Platkloof, Citrusdal (CA), *Hanekom 1241* (K, PRE).

3318 (Cape Town) near Mamre (AD-BC), *MacOwan 2488* (K, SAM); Porterville (BB), *Loubser 485* (NBG), 401 (BOL); Twenty Four Rivers, damp slope near road bridge, *Goldblatt 6409* (K, MO, NBG, S); Twenty Four Streams, near Saron, *Lewis s.n.* (BOL 31877); damp places near Malmesbury, 120 m (BC), *Schlechter 1625* (B, BOL, BR, L, PRE, Z); hills near Malmesbury, 300 m, *Schlechter 1656* (BR, L, Z); near Malmesbury, *MacOwan s.n. Herb. Norm. Austr. Afr. 1568* (B, G, K, Z); N of Hermon, in clayish sand, *Goldblatt 6410* (MO); Kalabas Kraal (DA), *Barker 2543* (NBG); Paardeberg (DB), *Salter 7663* (SAM); near Durbanville (DC), *Compton 16016* (BOL, NBG); flats between Durbanville and Phesantekraal, *Leighton 557* (BOL); Bottelary road, near Stellenbosch (DD), *Lewis 2232 & Davis* (SAM); near Stellenbosch, *L. Bolus s.n.* (BOL); slopes of the Bottelary hills, *Acocks 3703A* (S); Stellenbosch Golf Course, *Bos 659* (STE, WAG); Stellenbosch Flats, *Garside 87* (K), 1050 (K).

3319 (Worcester) Saron, sandy flats (AA), *Lewis 5736* (NBG), *Martin s.n.* (NBG 60409); De Hoek Estates, near Saron, *Lewis s.n.* (BOL 31878); foot of Elands-kloof Mts., Elandsrivier Farm (AC), *Goldblatt 5856* (MO); Commonage at Gouda, damp depressions, *Goldblatt 4214* (MO); Steendal, Tulbagh, *Pappe s.n.* (BOL); Wolseley, *Loubser 475* (NBG); Michells Pass, 1,500 ft. (AD), *Schlechter 8931* (B, BM, BOL, G, H, K, L, MO, PH, S, Z); Breede River flats near Worcester (CB), *Goldblatt 6982* (MO).

3418 (Simonstown) near Somerset West (BB), *Ecklon & Zeyher Irid. 211* (83) (B, BM, FI, K, MO, SAM); low lying fields, Somerset West, *H. Bolus 5567* (BOL, K); Vergelegen, swamp, *Lewis 5672* (NBG, STE); Faure, *van Niekerk 276* (BOL).

WITHOUT PRECISE LOCALITY: *Harvey 873* (E), 880 (E), *Thunberg s.n.* (Herb. Thunb. 991, 992, 961, UPS); between Piketberg and Piketberg Road Station, *H. Bo-*

lus s.n. (BOL), *Masson* s.n. "*Ixia obtusata* B" (BM), s.n. "*Ixia graminea* J. B." (BM), *Roxburgh* s.n. (BM "*Ixia obtusata* B," G).

- 51. *Geissorhiza purpureolutea* Baker, J. Bot. n.s. 5: 238. 1876, Fl. Cap. 6: 68. 1896; Foster, Contr. Gray Herb. 135: 33–34. 1941. TYPE: South Africa. Cape: between Paarl and Pont, Drège 8476 [lectotype, K, effectively designated by Foster (1941); isoelectotypes, G, L]. FIGURES 9, 59.**

Geissorhiza sulphurea Schltr., Bot. Jahrb. Syst. 27: 99. 1899; Foster, Contr. Gray Herb. 135: 36–37. 1941 excl. var. *arenicola*. TYPE: South Africa. Cape: damp places near Ceres Road (Wolseley), Schlechter 8981 [lectotype, B, effectively designated by Foster (1941); isoelectotypes, BM, BOL, BR, E, G, H, K, MO, P, PH, PRE, S, Z].

Plants (4–)6–12(–17) cm high. *Corm* globose, more or less symmetric, 5–7 mm diam., tunics blackish, imbricate, regularly notched below into segments. *Cataphyll* not evident. *Leaves* 3, linear to narrowly ensiform, 1–2.5 mm wide, half as long to rarely as long as the stem, the margins and midrib strongly thickened, 2-grooved on each surface, more rarely 4 to several ribbed and grooved, the lower two leaves basal, the uppermost leaf largest, inserted near the base or on the lower part of the stem, sheathing the stem below for half its length, sheath inflated and strongly ribbed. *Stem* erect, simple. *Spike* 1–3(–5)-flowered, flexuose; *bracts* herbaceous, usually red-flushed near the apex, sometimes dry in the upper half at flowering time, 7–8 mm long. *Flowers* stellate, cream to pale yellow, usually intense brown (to purple) in the basal third of the tepals and tube, rarely self-colored, often reddish on the reverse of the outer tepals; *perianth tube* (2–)3–4 mm long, infundibuliform, usually about half as long as the bracts; *tepals* 10–17(–22) mm long, obovate 7–8 mm wide. *Filaments* equal, 5–6 mm long, often dark in the lower half; *anthers* 4–6 mm long, yellow. *Ovary* 2–3 mm long, style dividing near the apex of the anthers, branches ca. 2.5 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. Mid-August to mid-September.

Distribution. Wet, sandy gravel flats, on the coastal plain between Paarl and Piketberg and in the Tulbagh Valley. Figure 59.

Geissorhiza purpureolutea is a rare species of damp, poorly drained flats in the southwestern

Cape. Its main range is the coastal lowlands between Paarl and Piketberg but it also occurs in the upper Tulbagh Valley, to the interior. Typical *G. purpureolutea* has moderate-sized cream to yellow flowers with a dark brown to purple center. In a collection from west of Malmesbury (*Lewis & Davis* 2233) several plants have either a typical or much reduced marking or it may be lacking. A second collection from this same general area in the west of the range of the species, *Salter* 4756, consists mostly of plants lacking markings entirely (one plant has a dark throat), but in all other respects match the Lewis and Davis collection, as well as some other collections (e.g., *Loubser* 2034 from Piketberg) which have flowers slightly on the small side for the species.

These specimens that lack the central contrasting blotch match very closely collections in the Wolseley-Romans River area in the lower Tulbagh Valley, amongst which is *Schlechter* 8981, the type collection of *Geissorhiza sulphurea*. The Schlechter collection itself consists of rather small-flowered plants (tepals ca. 10 mm long), but the other collections from here (*Salter* 6836, *Goldblatt* 2432), have flowers of the same size (tepals 12–15 mm long) as typical *G. purpureolutea*. It seems likely that these collections represent nothing more than self-colored *G. purpureolutea*, and accordingly *G. sulphurea* is reduced to synonymy here.

Geissorhiza purpureolutea is closely allied to the *G. imbricata* complex from which it can usually be distinguished by its shorter perianth tube, 2–4 mm long, comparatively small flowers with tepals 10–17(–22) mm long, usually with a large central blotch of dark color, spikes of 1–3(–5) flowers and narrow basal leaves to 2.5 mm wide and usually 2 (rarely 4 to several) grooved.

A collection from the Darling area (*Lotter* s.n.) represents an unusual form of *Geissorhiza purpureolutea*. Plants have broad, several grooved leaves, and large flowers (tepals 20–22 mm long) with the typically short perianth tube of the species. The spikes have three or four flowers each. These plants are taken to be an extremely robust form of *G. purpureolutea*, rather than a separate taxon.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) ca. 10 mi. N of Piketberg (DD), *Loubser* 2034 (NBG); foot of Zebrakop, S of Eendekuil turnoff in gravelly soil, *Goldblatt* 6129 (MO, NBG).

3318 (Cape Town) 18 mi. from Malmesbury on Hopefield road, damp ground (BA), *Lewis & Davis* s.n.

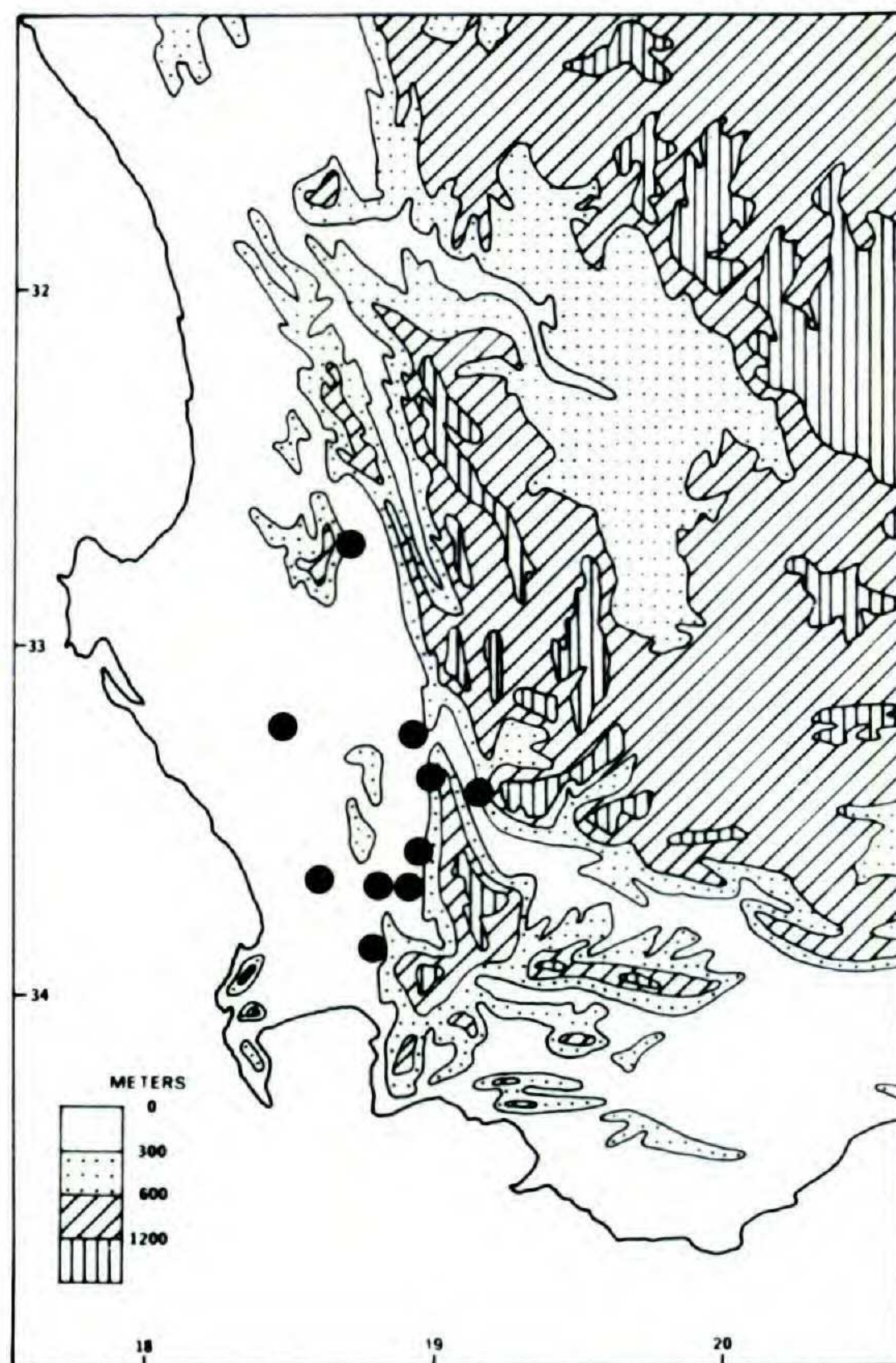
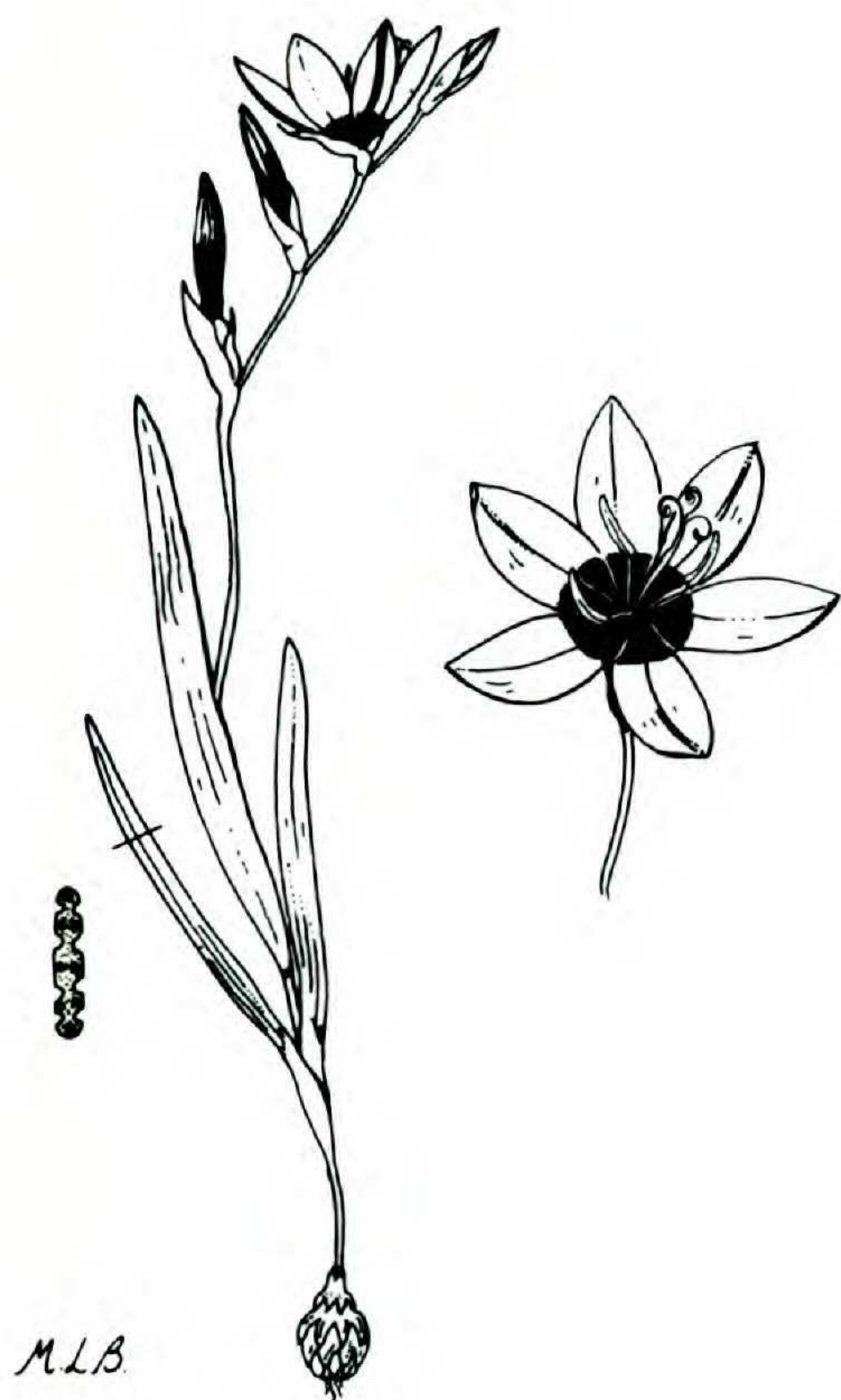


FIGURE 59. Morphology and distribution of *Geissorhiza purpureolutea*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6129, foot of Zebrakop).

(PRE, SAM 60696); Oudepost, *Salter* 4756 (BM, BOL, K); Spieka, near Klipheuwel, flats near river (DA), *Thompson* 2613 (PRE, STE); near Wellington (DB), *L. Bolus* s.n. (BOL 20327, K, PRE), *Compton* 11731 (NBG), *Barker* 408 (NBG); near Paarl, *Barker* 5948 (NBG); Paarl flats, N end, *Esterhuysen* 6125 (BOL); between Paarl and Pont, *Drège* 8475 (G, L), 8476 (G, K, L); flats N of Paarl, *Leighton* 1960 (PRE); Huguenot, *Compton* 18257 (NBG); ? near Stellenbosch (DD), *Edwards* s.n. (BOL).

3319 (Worcester) Gouda commonage, heavy clay soil (AC), *Goldblatt* 2432A (K, MO, PRE); Ceres Road (Wolseley), 700 ft., *Schlechter* 8981 (B, BM, BOL, E, G, H, K, MO, P, PH, PRE, S, Z); between Darling Bridge and Romans River Siding, *Salter* 6836 (BOL); flats between Bains Kloof and Wolseley, *Goldblatt* 2432 (MO, PRE, US); Elandsberg farm, S of Gouda, *Goldblatt* 6209 (MO).

52. *Geissorhiza barkerae* Goldbl., sp. nov. TYPE: South Africa. Cape: N of Piketberg, wet sites at the foot of Zebrakop, *Goldblatt* 6391 (holotype, MO; isotypes, K, NBG, PRE, S, WAG). FIGURES 8, 60.

Planta 10–20 cm alta, foliis 3 inferioribus duobus basalibus lineari-ensiformibus marginibus costisque incrassatis, superiore infra inflato et vaginante, caule erecto saepe simplici, spica 2–4(–10) florum, floribus zygomorphis flavis atropurpureis insignis, tubo perianthii 7–8 mm longo, tepalis 22–30 mm longis, fila-

mentis inaequalibus declinatis 15–20 mm longis, uno 5–6 mm brevior quam aliis, antheris 5–6 mm longis.

Plants 10–20 cm high. *Corm* globose, more or less symmetric, 7–11 mm diam., tunics blackish, imbricate, regularly notched below into segments. *Cataphyll* not evident. *Leaves* 3, linear (to ensiform), 1–4 mm wide, (2 to) 4 to several ribbed on each surface, about as long as the stem, the lower two basal, the uppermost largest, inserted near the base or in the lower part of the stem, sheathing the stem for half its length, the sheath inflated and strongly ribbed. *Stem* erect, usually 1-branched, flexed above the sheath of the upper leaf. *Spike* (2–)4–10-flowered, flexuose; *bracts* herbaceous, the upper margins hyaline, becoming dry and usually red-flushed near the apex, sometimes dry above at flowering time, 10–13 mm long. *Flowers* zygomorphic, with the style and stamens declinate and held above the nearly horizontal upper tepal, pale yellow marked with purple in the lower half of the tepals and yellow in the center and tube, often reddish on the reverse of the outer tepals; *perianth tube* 7–8 mm long, infundibuliform; *tepals* 22–30 mm long, lanceolate, 8–9 mm wide. *Filaments* unequal, two longer, 15–20 mm, the shorter, 10–14 mm long, yellow; *anthers* 5–6 mm long, yellow.

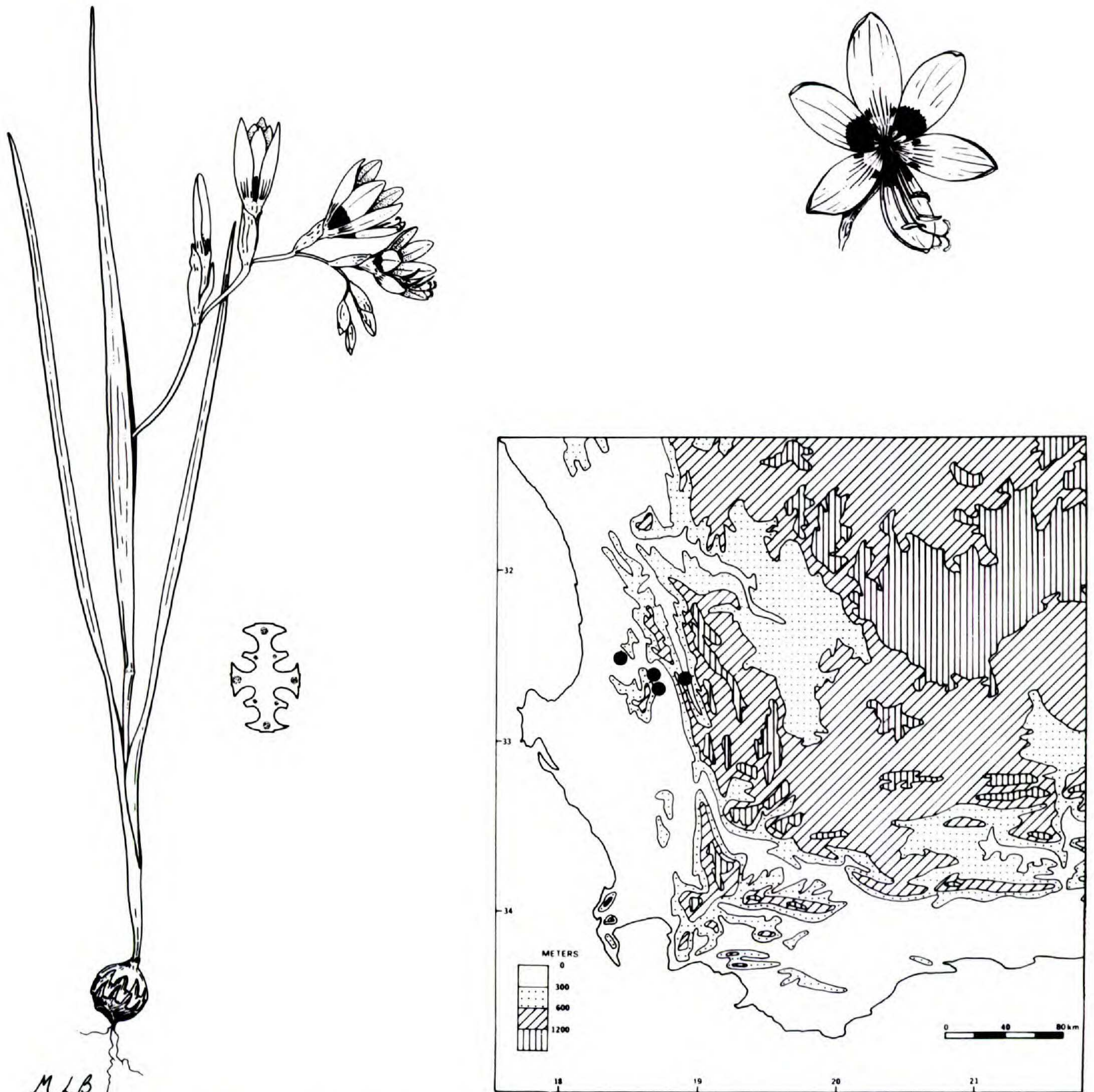


FIGURE 60. Morphology and distribution of *Geissorhiza barkerae*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6391, foot of Zebrakop).

low. Ovary ca. 2–3 mm long, style dividing near the apex of the anthers, branches ca. 5 mm long, recurved. Capsule unknown. Chromosome number, $2n = 26$ (Goldblatt 6391).

Flowering time. Mid-September to mid-October.

Distribution. Seasonal marshes and stream banks in sand or light clay north and northwest of Piketberg, and locally in the Olifants River Valley. Figure 60.

Geissorhiza barkerae is a very distinctive species, with a local distribution, north and west

of Piketberg, where it grows in seasonally flooded or waterlogged sandy or light clay soils. It is allied to *G. imbricata* especially subsp. *bicolor* which occurs in similar habitats to the south and to *G. louisabolusiaae* which occurs in the Olifants River Valley to the north. It can readily be distinguished from these two species by its large, zygomorphic flowers borne on drooping spikes of up to ten flowers. The flowers are pale yellow with dark purple in the lower part of the tepals while the throat and tube are also yellow. The stamens are declinate and very unequal, with the two longer filaments 15–20 mm long and the

shorter one about two-thirds this length. In contrast, *G. imbricata* subsp. *bicolor* has somewhat smaller and actinomorphic flowers sometimes with a dark center, and then usually a dark perianth tube (not so in the type). It also has fewer flowers in a spike (2–5, rarely to 10), and equal filaments. *Geissorhiza lousabolusia* has self-colored, and smaller, deeper yellow flowers with a shorter perianth tube, and subequal to slightly unequal filaments, and typically much narrower, linear, 2-grooved leaves.

I have pleasure in naming this species in honor of W. F. Barker, the South African botanist, and retired Curator of the Compton Herbarium, Kirstenbosch. Her extensive collecting over many years has been of great value, particularly as she has taken great care in preparation of her specimens, thus making many characters easy to see which would otherwise be lost, and thus require recollecting.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Papkuils Vlei (CB), *Leighton* 121 (BOL, PRE), *Compton* 9502 (NBG, W), *Barker* 2639 (BOL, NBG); Vogelvlei, near Eendekuil (DB), *Marloth* 9247 (PRE); flats at foot of Zebrakop, S of Concordia farm, *Goldblatt* 6391 (K, MO, NBG, PRE, S, WAG); N of Piketberg, wet ground along road to Het Kruis, *Goldblatt* 542 (BOL).

3219 (Wuppertal) Warm Baths, Clanwilliam (CA), *Leipoldt* s.n. (BOL 31881, K).

WITHOUT PRECISE LOCALITY: Sandveld between Greys Pass and Graafwater, *Leipoldt* 3585 (BOL); Cape Town Wild Flower Show, Oct. 1939, *Anon.* (BOL 31880); "Tulbagh," *Thom* s.n. (K).

53. *Geissorhiza lousabolusia* Foster, Contr. Gray Herb. 135: 34. 1941, pro parte excl. var. *longifolia*. TYPE: South Africa. Cape: 6 mi. E of Graafwater, *Salter* 2790 (holotype, K; isotypes, BM, BOL). FIGURE 61.

Plants (10–)15–20 cm high. *Corm* globose, 7–9 mm diam., symmetric, tunics blackish, imbricate, notched into regular segments below. *Cataphyll* not evident. *Leaves* 3, linear to nearly terete, 1–2 mm wide, reaching to about the base of the spike, narrowly 4–6(–8)-grooved on each surface, the lower two leaves basal, the uppermost basal or inserted shortly above the ground and largest, sheathing the stem below, the sheath ribbed and inflated. *Stem* erect, sheathed for half to two-thirds its length, flexed above the sheath, occasionally with 1 branch. *Spike* flexuose, inclined (2–)3–7-flowered; *bracts* herbaceous, occasionally the margin lined red above, often becoming dry and membranous from the apex, 8–

10 mm long, the inner shorter than the outer. *Flower* actinomorphic, the tepals somewhat cupped, bright yellow; *perianth tube* 4–6 mm long, nearly reaching the apex of the bracts (exserted in old blooms), infundibuliform; *tepals* 18–28 mm long, 7–9 mm wide, oval. *Filaments* nearly equal to unequal, longer two 7–9 mm long, the third if shorter, 5–7 mm long; *anthers* 4.5–6 mm long, yellow. *Ovary* ca. 2–3 mm long, *style* dividing near the apex of the anthers, branches ca. 2 mm long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (*Goldblatt* 427).

Flowering time. Late August to September.

Distribution. Damp often waterlogged sand or shallow vleis, in the Olifants River Valley and valleys of the Olifants River Mountains to the west. Figure 61.

Geissorhiza lousabolusia has a limited distribution, occurring in the Olifants River Valley and the adjacent valleys of the Olifants River Mountains to the west. It is restricted to wet sandy flats and vleis that are waterlogged in the late winter and spring. This habitat is now becoming much reduced owing to the expanding citrus and deciduous fruit orchards that have been developed in this area, and *G. lousabolusia* is, as a result, rapidly becoming endangered.

It appears to be a member of the *G. imbricata* group and although it does not have the corrugated leaves typical of the alliance, the sheathing part of the upper leaf is characteristically ribbed and grooved. It appears to be most closely related to the southwestern Cape species *G. brehmii* (syn. *G. teretifolia*) but it can readily be distinguished from this species. *Geissorhiza lousabolusia* has deep yellow flowers with a relatively short perianth tube, 4–6 mm long, a flower with ascending somewhat cupped tepals, and usually one stamen slightly to appreciably shorter than the others. In contrast, *G. brehmii* usually has a longer perianth tube, 5–9 mm long, either white, cream, or pale yellow flowers, sometimes with a dark center and equal stamens. The leaves of *G. lousabolusia* are more or less terete and narrowly 4–6(–8)-grooved, with the two basal equally well-developed, while those of *G. brehmii* are fully terete and inflated, always 4-grooved and the lowermost of the basal leaves is much smaller than the other, sometimes being vestigial or even absent.

The variety *Geissorhiza lousabolusia* var. *longifolia* recognized by Foster (1941), based on a Bachmann collection from near Moorreesburg

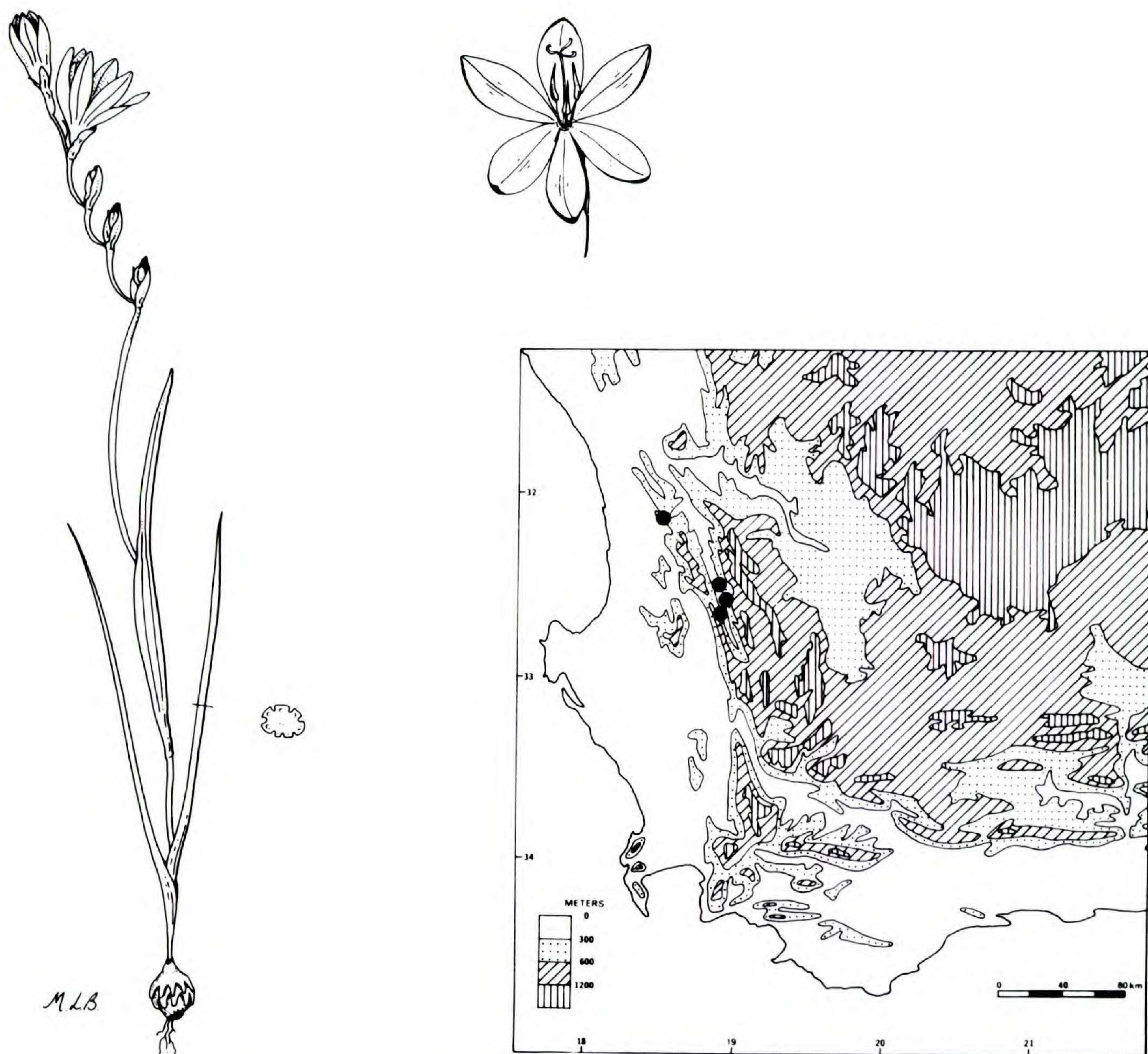


FIGURE 61. Morphology and distribution of *Geissorhiza lousabolusiae*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt 6268*, flats N of Citrusdal).

is here referred to *Geissorhiza brehmii*. It appears to be no more than a robust form of this species but quite characteristic in its long perianth tube, inflated terete leaves, and much reduced or lacking lowermost leaf.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) 6 mi. E of Graafwater (BA), *Salter 2790* (BM, BOL, K).

3318 (Wuppertal) Citrusdal (CA), *Barker 7343* (NBG), 3078 (BOL, NBG), *Leighton 1090* (BOL); flats N of Citrusdal, *Salter 3659* (BM, BOL, K), *Goldblatt 247* (BOL), *Goldblatt 6268* (MO); 5 mi. N of Citrusdal, *Lewis 1416* (SAM); Citrusdal vlei, *Barker 3604* (NBG); Warm Baths, Olifants River Valley, *Leipoldt s.n.* (BOL 31879); Leeu River bridge, growing in vlei (CC), *Horrocks 32* (NBG).

54. *Geissorhiza brehmii* Ecklon ex Klatt, *Linnaea* 34: 653–654. 1866. *Geissorhiza im-*

bricata var. *brehmii* (Klatt) Foster, *Contr. Gray Herb.* 135: 38. 1941. TYPE: South Africa. Cape: Hottentots Holland, about Somerset West, *Ecklon & Zeyher Irid.* 295 (83) [lectotype, B, effectively designated by Foster (1941: 38); isolectotypes, FI, G]; Cape, about Somerset West, *Ecklon & Zeyher Irid.* 211 “*G. aurea*” [syntypes, B, FI, MO, SAM = *G. bicolor* (Thunb.) N. E. Brown sensu lato].

Geissorhiza lousabolusii var. *longifolia* Foster, *Contr. Gray Herb.* 135: 34. 1941. TYPE: South Africa. Cape: road to Mooresburg, Malmesbury, *Bachmann 1091* (holotype, B; isotype, Z).

Geissorhiza teretifolia Lewis, *J. S. African Bot.* 7: 48. 1941. TYPE: South Africa. Cape: Kenilworth Race Course, *Lewis 97* (holotype, SAM 53064).

Plants 20–30 cm high. *Corm* 8–12 mm diam., globose, tunics blackish, imbricate, the outer lay-

ers accumulating above, regularly notched below into triangular segments. *Cataphyll* single, extending shortly above ground, firm membranous. *Leaves* 2 or 3, usually terete and inflated or somewhat succulent with 4 very narrow longitudinal grooves running the length of the leaf, the lower one or two basal, the lowermost small, often broken, or vestigial (occasionally lacking), the second about as long as the stem, the uppermost usually inserted on the stem shortly above the ground, sheathing below, the sheath ribbed and inflated, the free upper part often as long as the basal leaf (or leaves), terete or occasionally ribbed. *Stem* erect, often branched. *Spike* 2–6-flowered, flexuose; *bracts* herbaceous, becoming dry and membranous from the apex, 7–10 (–15) mm long, the inner smaller than the outer. *Flower* more or less stellate, white to cream, sometimes purple-flushed on the reverse of outer tepals, occasionally dark colored in the throat and tube; *perianth tube* 5–7 (–9) mm long, slightly shorter than, or reaching the apex of the bracts; *tepals* 15–20 (–26) mm long to 9 mm wide, obovate, obtuse. *Filaments* 5–9 mm long, equal; *anthers* ca. 5 mm long. *Ovary* ca. 2 mm long, *style* dividing near the apex of the anthers, *branches* 3–4 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. (August to) September to October.

Distribution. Cape Peninsula, north to the Malmesbury district and east to Caledon and Bredasdorp in sandy ground, either swampy, or seasonally flooded, or at edges of pools. Figure 62.

Geissorhiza brehmii is closely related to *G. imbricata* especially to subsp. *bicolor* (here including *G. rubicunda*) and the two taxa have a similar general appearance and flower. *Geissorhiza brehmii* grows in wetter habitats, usually in standing water, or in sites usually flooded in the winter, but sometimes nearly dry by flowering time. It can be distinguished by its habitat and otherwise only in its vegetative characteristics, by its slender terete and slightly succulent, narrowly 4-grooved leaf, the lowermost of which is often much smaller than the others, or even vestigial or lacking. *Geissorhiza imbricata* has in contrast linear to ensiform, several ribbed, flat leaves, the lower of which is always well developed. Occasional narrow-leaved individuals of *G. imbricata* subsp. *bicolor* are encountered (e.g., Goldblatt 6409) but leaves of these plants are not terete or

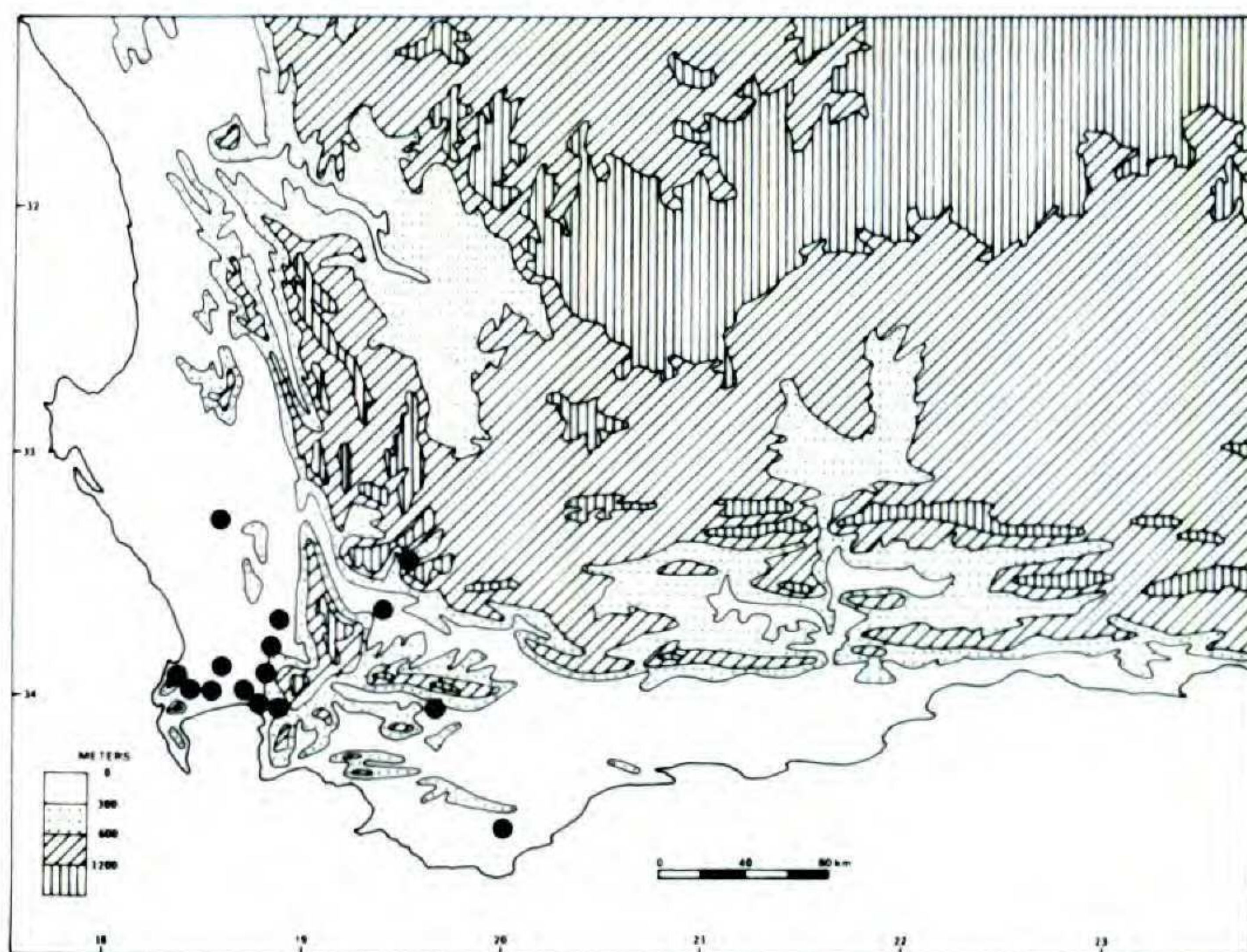


FIGURE 62. Distribution of *Geissorhiza brehmii*.

inflated and can be seen under a lens to be 1–2-ribbed on each surface. In some collections of *G. brehmii* one or a few plants may have ribbed leaves (e.g., Compton 20095), and it becomes very difficult to distinguish such specimens from subsp. *bicolor*.

As published, *Geissorhiza brehmii* appears to be a superfluous name for Klatt (1866) who cited two apparent synonyms in the protologue, “*G. setacea* Gawl.” and “*G. aurea* Ecklon.” However, Klatt was almost certainly citing *G. setacea* in reference to the “Botanical Magazine” fig. 1255 which Ker (Ker-Gawler) identified as *G. setacea* although in fact it is not this species, but probably *G. hispidula* (syn. *G. humilis* var. *hispidula* Foster). Klatt’s intention seems to have been to draw attention to *G. setacea* sensu Ker as distinct from the true *G. setacea* based on the Thunberg type. The other name cited, *G. aurea* Ecklon, is a nomen nudum.

Klatt cited two collections in his description of *Geissorhiza brehmii*, both from near Somerset West, Ecklon & Zeyher Irid. 295 (*G. brehmii* Ecklon ms.) and Ecklon & Zeyher Irid. 211 (*G. aurea* Ecklon ms.). These are different species, the latter being a cream- to yellow-flowered form of *G. bicolor* with self-colored flowers and relatively broad leaves with obtuse apices. Foster effectively designated Ecklon & Zeyher Irid. 295 as the lectotype for *G. brehmii* when he reduced it to varietal rank in *G. imbricata*, where it was distinguished by its narrow leaves. Lewis (1941) quite independently described *G. teretifolia* based on collections from the Cape Peninsula, before Foster’s (1941) revision was published. *Geissorhiza teretifolia* differs in no significant way from *G. brehmii*, although the material cited by Lewis

is in general more robust than the lectotype of *G. brehmii* and has white flowers.

Most populations of *Geissorhiza brehmii* have white- to cream-colored flowers, with a faint pink flush on the reverse of the outer tepals. Plants from Mulders Vlei and Kraaifontein in the northern Cape Flats, however, apparently have cream flowers (yellow on drying) with a distinct red streak on the reverse of the outer tepals and a dark color in the throat and tube of the perianth. The Kraaifontein population (Compton 20095) comprises plants with either a dark, or self-colored throat and tube, while in the Mulders Vlei population (Lewis 4447) all plants have the dark color in the center of the flower. Some plants of this collection also have unusually large flowers, with tepals to 26 mm long and perianth tube to 9 mm. There seems no reason, however, to treat this form as a separate taxon.

Other large-flowered populations have been recorded, e.g., *Bachmann 1091* and *H. Bolus 4339*. Plants of these collections have apparently cream-colored flowers without any marking on the reverse of the tepals. These have either only one basal leaf, or at most a vestigial second basal leaf. The Bachmann collection is the type collection of Foster's *Geissorhiza lousabolusia* var. *longifolia*. *Geissorhiza lousabolusia* is in fact, superficially similar to *G. brehmii*, but always has two well-developed basal leaves, usually a shorter perianth tube, and subequal to unequal stamens. Differences between these two species, in leaf morphology and in the length of the perianth tube, make it easy to distinguish them. *Geissorhiza lousabolusia* var. *longifolia* is here reduced to synonymy in *G. brehmii*.

Geissorhiza brehmii has been confused at times with *G. hispidula* (Klatt, 1866) and with *G. geminata* (Foster 1941: 78). Several collections of *G. hispidula* made by Ecklon and Zeyher bear the manuscript name *G. brehmii*. Both *G. hispidula* and *G. geminata* (subgenus *Weihea*) have concentric corm tunics and are unrelated to *G. brehmii*, which has imbricate tunics typical of subgenus *Geissorhiza*.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Hopefield district (?AB), *Bachmann 1090* (Z); road to Moorreesburg (?BA), *Bachmann 1091* (B, Z); Kenilworth Race Course, in pools (CD), *Lewis 4796* (PRE, SAM), 97 (SAM), 480 (SAM), *Barker 4795* (NBG), 4115 (NBG), *Salter 7738* (BM, BOL, CT, K, SAM), *Dümmer 724* (E); wet places on Table Mt., 2,300 ft., *Schlechter 92* (B, G, W); Kraaifontein (DC), *Compton 20095* (BOL, NBG, STE); Bergrivier at Paarl, "feuchten Wiesen und in Dümpfel" (DD), *Drège 8472*

(B, BM, E, K, L, MO, P, S); Stellenbosch flats, *Holzappel 6* (STE), *Garside 1063* (K); Old Golf Course, Stellenbosch, *Du Preez s.n.* (STE); Mulders Vlei, *Lewis 4447* (PRE, SAM).

3319 (Worcester) Hex River Valley (BC-CB), *Davidson 75* (SAM); between Worcester and Villiersdorp (CD), *Lewis 2899* (SAM), 2900 (SAM).

3418 (Simonstown) Ottery Road Station (AB), *Lewis 130* (SAM); Wynberg, *Wilms 3733* (B), *Schlechter 1557* (B, G, M, W, Z); Cape flats (BA), *Ecklon & Zeyher 427* (BOL, SAM); farm Vergenoeg, near Faure, damp sandy flats, *Thompson 2114* (PRE, STE); wet sandy flats between Gordon's Bay and Strand (BB), *Esterhuysen 23133*; Hottentots Holland, *Drège 8465* (S); near Somerset West, *Ecklon & Zeyher Irid. 295* (83) (B, FI, G).

3419 (Caledon) damp slopes and ditch, Lindeshof (BB), *Lewis 5658* (NBG, STE); The Poort, Bredasdorp, in swampy ground (DB), *Dymond s.n.* (BOL 21227), *Barker 2493* (NBG).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, *Siebold 526* (B), *Ecklon s.n.* (PRE); Zonderend Mts., *Stokoe s.n.* (SAM 57388).

55. *Geissorhiza sulphurascens* Schltr. ex Foster, Contr. Gray Herb. 35: 39. 1941. TYPE: South Africa. Cape: Bokkeveld W of Nieuwoudtville, *Marloth 7658* (holotype, B; isotype, PRE). FIGURE 63.

Plants 12–20 cm high. *Corm* globose, 6–8 mm diam., symmetric, tunics blackish, imbricate, notched into regular segments below. *Cataphyll* not evident. *Leaves* 3, narrow, linear, ca. 1 mm wide, reaching the midline of the stem or the base of the spike, the margins and midrib enlarged and 2-grooved on each surface, the lower two leaves basal, the uppermost basal or inserted just above the ground, largest, sheathing the stem in its lower two-thirds, the sheath ribbed and inflated. *Stem* erect, sheathed below for about two-thirds its length, flexed above the sheath of the upper leaf, occasionally with 1 branch. *Spike* flexuose, inclined, 4–8(–10)-flowered; *bracts* herbaceous, the margin often lined red above, sometimes becoming dry and brownish from the apex, 7–9 mm long, the inner shorter than the outer. *Flower* stellate, or the tepals slightly cupped, cream; *perianth tube* 3–4 mm long, enclosed in the bracts, infundibuliform; *tepals* 13–18 mm long, 5–7 mm wide, oval. *Filaments* equal, 5–8 mm long; *anthers* ca. 6 mm long, pale yellow. *Ovary* ca. 2.5 mm long, *style* dividing at the apex of the anthers, branches ca. 2 mm long, recurved. *Capsule* more or less globose about 5 mm long. *Chromosome number*, unknown.

Flowering time. Late August to September.

Distribution. Nieuwoudtville Escarpment, in damp sand. Figure 63.

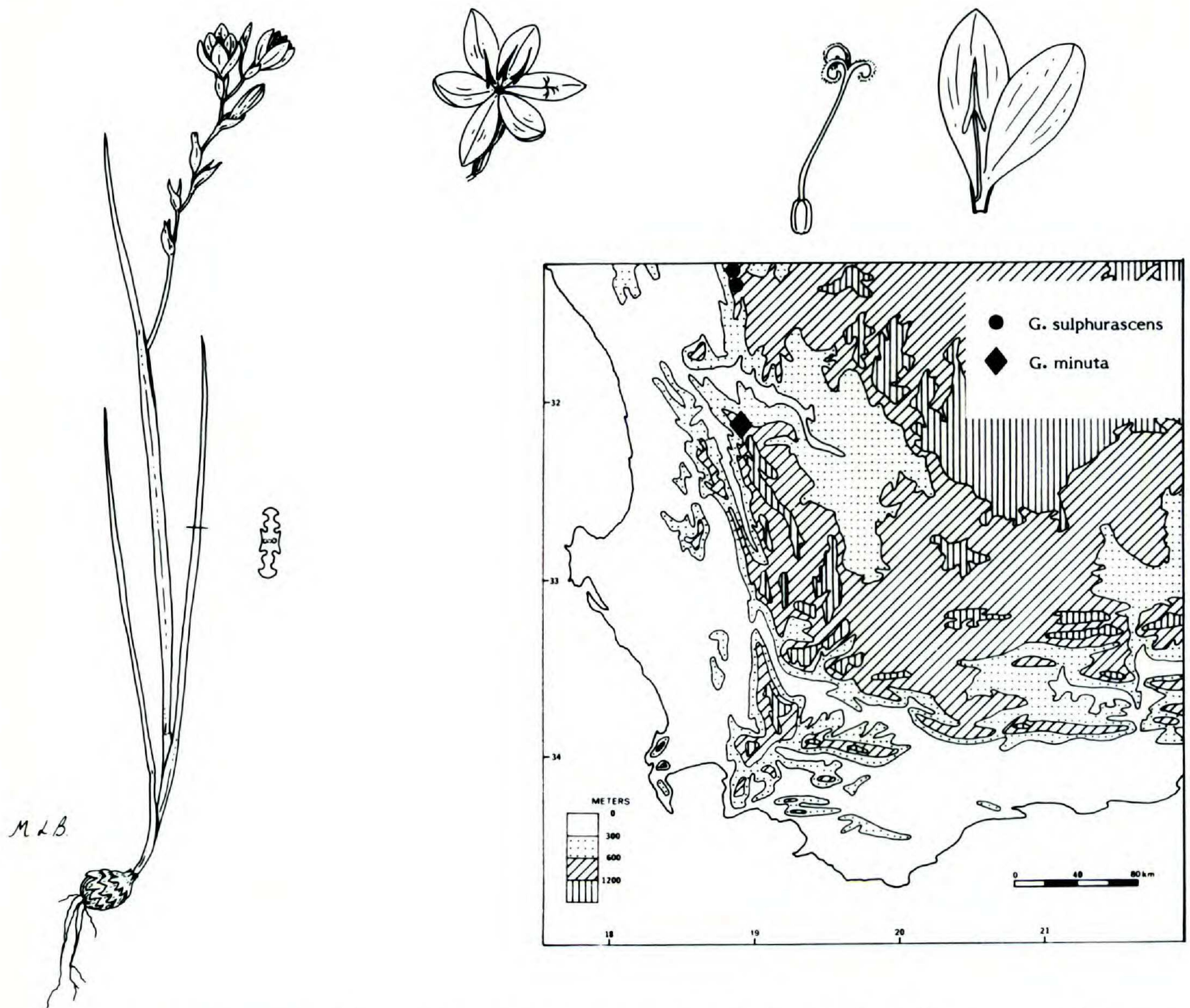


FIGURE 63. Morphology of *Geissorhiza sulphurascens* and distribution of *G. sulphurascens* and *G. minuta*. Habit $\times 0.5$; flower life size; partial flower and gynoecium $\times 1.5$; leaf section much enlarged (Goldblatt 5841, Grasberg road, Nieuwoudtville).

Geissorhiza sulphurascens is endemic to the Bokkeveld Escarpment where it is common in the Nieuwoudtville-Van Rhyns Pass area on poorly drained, wet, sandy sites. It is related to the *G. imbricata* group, the other species of which occur to the south from the Olifants River Valley to the Cape Peninsula and Bredasdorp. While it seems somewhat isolated taxonomically, it is perhaps most closely related to *G. louisabolusiae* a species with fewer and larger, bright yellow flowers on a lax inflorescence and typically unequal stamens. The pale creamy yellow flowers and congested inflorescence of *G. sulphurascens* are distinctive, as are the linear and 4-grooved basal leaves and well-developed uppermost leaf which sheaths at least two-thirds of the stem.

Specimens examined. SOUTH AFRICA. CAPE: 3119 (Calvinia) Nieuwoudtville Escarpment NW of Van

Rhyns Pass (AC), *Oliver* 3849 (K, PRE, STE); Nieuwoudtville, *L. Bolus* s.n. (PRE 36875), *Loubser* 953 (NBG); Willemsrivier, *Leipoldt* 720 (BOL, PRE); marshy soil near Nieuwoudtville, *Leipoldt* 792 (BOL); Bokkeveld W of Nieuwoudtville, *Marloth* 7658 (B, PRE); Grasberg road, NW of Nieuwoudtville, damp sandy soil, *Barker* 9559 (NBG), *Goldblatt* 5841 (MO, PRE, S); Meulsteenvlei, near edge of escarpment W of Nieuwoudtville, *Lewis* 5870 (NBG); 4 km NW of Nieuwoudtville on Grasberg road, *Goldblatt* 6218 (MO); 2 mi. W of Nieuwoudtville, *Hall* 3874 (NBG); Uitkomst farm SW of Nieuwoudtville, in sand, *Barker* 10740 (K, NBG).

56. *Geissorhiza minuta* Goldbl., sp. nov. TYPE: South Africa. Cape: Pakhuis Pass, *Esterhuysen* 3193 (holotype, BOL; isotypes, K, MO).

Planta 3–8(–12) cm alta, tunicis cormi imbricatis, foliis 3, inferioribus duobus basalibus linearibus,

superiore caulem vaginante, caule erecto, spica 2–6 florum, floribus stellatis, albis, tubo ca. 1 mm longo, tepalis 7–8 mm longis, antheris 2–3 mm longis, stylo diviso prope apicem antherarum.

Plants 3–8(–12) cm high. *Corm* globose, 5–6 mm diam., symmetric, tunics blackish, imbricate, notched into regular segments below. *Cataphyll* not evident. *Leaves* 3, linear, ca. 1 mm wide, about as long as the spike, the margins and midrib enlarged and 2-grooved on each surface, the lower two leaves basal, the uppermost basal or inserted just above the ground, longer or shorter than the lower leaves, sheathing the stem in its lower two-thirds, the sheath ribbed and somewhat inflated. *Stem* erect, sheathed for about two-thirds its length, flexed above the sheath of the upper leaf, occasionally with 1 branch from the base. *Spike* flexuose, inclined, 2–6-flowered; *bracts* herbaceous, the upper margin often red, sometimes becoming dry and brownish from the apex, 4–5 mm long, the inner about as long as the outer. *Flower* evidently white, stellate; *perianth tube* ca. 1 mm long, enclosed in the bracts, infundibuliform; *tepals* 7–8 mm long, ca. 2.5 mm wide, oval. *Filaments* apparently equal, 2–3 mm long; *anthers* 2–3 mm long, pale yellow. *Ovary* ca. 1 mm long, *style* dividing just beyond the apex of the anthers, branches 1–1.5 mm long, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to early October.

Distribution. Moist, rocky places in the Pakhuis Mountains. Figure 63.

Geissorhiza minuta is a dwarf species of subgenus and section *Geissorhiza*, apparently most closely related to *G. sulphurascens*, an endemic of the Nieuwoudtville Plateau. *Geissorhiza minuta* has white flowers, which are amongst the smallest in the genus. Its short perianth tube, ca. 1 mm long, tepals 7–8 mm long, and short anthers, 2–3 mm long, as well as slender habit and dwarf stature make confusion with any other species unlikely. It has only been collected in the vicinity of Pakhuis Pass and is probably endemic to this limited area to the north of the main Cedarberg range.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Pakhuis Pass, wet, mossy stones (AA), Bond 675 (NBG); Pakhuis Pass, Barker 4715 (NBG), Lewis 1871 (SAM); Pakhuis Pass, moist spot among rocks, Esterhuysen 3193 (BOL, MO).

57. *Geissorhiza eurystigma* L. Bolus, S. African Gard. 21: 282. 1931. *Geissorhiza mathewsii* var. *eurystigma* (L. Bolus) Foster, Contr. Gray Herb. 135: 27–28. 1941. TYPE: South Africa. Cape: near Mamre, L. Bolus s.n. (lectotype, BOL 19876, here designated; isolecotype, K). FIGURE 64.

Ixia secunda de la Roche, Diss. 17–18. 1766. *Geissorhiza monantha* Sweet, Hort. Brit. 2nd edition, 503. 1830, nom. nov. pro *Ixia secunda* de la Roche [*G. secunda* (Ker) Ker, 1804 bars transfer to *Geissorhiza* and treated here as a synonym of *G. monanthos* Ecklon, 1827 after Articles 64.2 and 75 of the Botanical Code of Nomenclature]. TYPE: South Africa. Cape: without precise locality, Anon. s.n. “*Ixia secunda* La Roche” (holotype, L).

Ixia rochensis Ker non sensu Ker, Bot. Mag. 17: tab. 598. 1802, nom. illeg. superfl. pro *I. secunda* de la Roche (misapplied to *G. radians*).

Geissorhiza rochensis (Ker) Ker, Ann. Bot. (König & Sims) 1: 221. 1804, nom. illeg. basion. illeg. superfl. (misapplied to *G. radians*).

Geissorhiza rochensis var. *monantha* (Sweet) Baker non sensu Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 71. 1896 (misapplied to *G. monanthos* Ecklon).

Ixia rochensis var. *spithamaea* Ker, Bot. Mag. 17: tab. 598. 1802. *Geissorhiza rochensis* var. *spithamaea* (Ker) Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 71. 1896, pro parte; Foster, Contr. Gray Herb. 135: 29–30. 1941, pro parte. TYPE: South Africa. Cape: precise locality unknown, Masson s.n. “*Ixia violacea*” (lectotype, BM, here designated).

Plants 8–15(–20) cm high. *Corm* globose, more or less symmetric, 8–11 mm diam., truncate at the base, tunics imbricate, blackish, layers notched below into regular segments. *Cataphyll* membranous or evidently lacking. *Leaves* 3, ensiform, conspicuously several ribbed, reaching to the base or middle of the spike, 3–6 mm wide, the lower two leaves basal, the uppermost inserted at the base or in the lower part of the stem, sheathing and inflated below, often as long and larger than the lower leaves. *Stem* flexed above sheath of the upper leaf and at the base of the spike, rarely bearing a bract-like leaf in the upper half, simple or 1–2-branched. *Spike* flexuose (1–) 2–5(–7)-flowered; *bracts* herbaceous, green, becoming dry and membranous from the apex and often reddish on the upper margin, 9–13 mm long, the inner about as long as the outer but narrower. *Flowers* evidently actinomorphic, the tepals widely cupped, dark blue with a red center; *perianth tube* fairly long, and widening gradually from the base, 6–9 mm long, exerted from the bracts; *tepals* 16–24 mm long, 9–13 mm wide, obovate, blue above, red in the lower half. *Fil-*

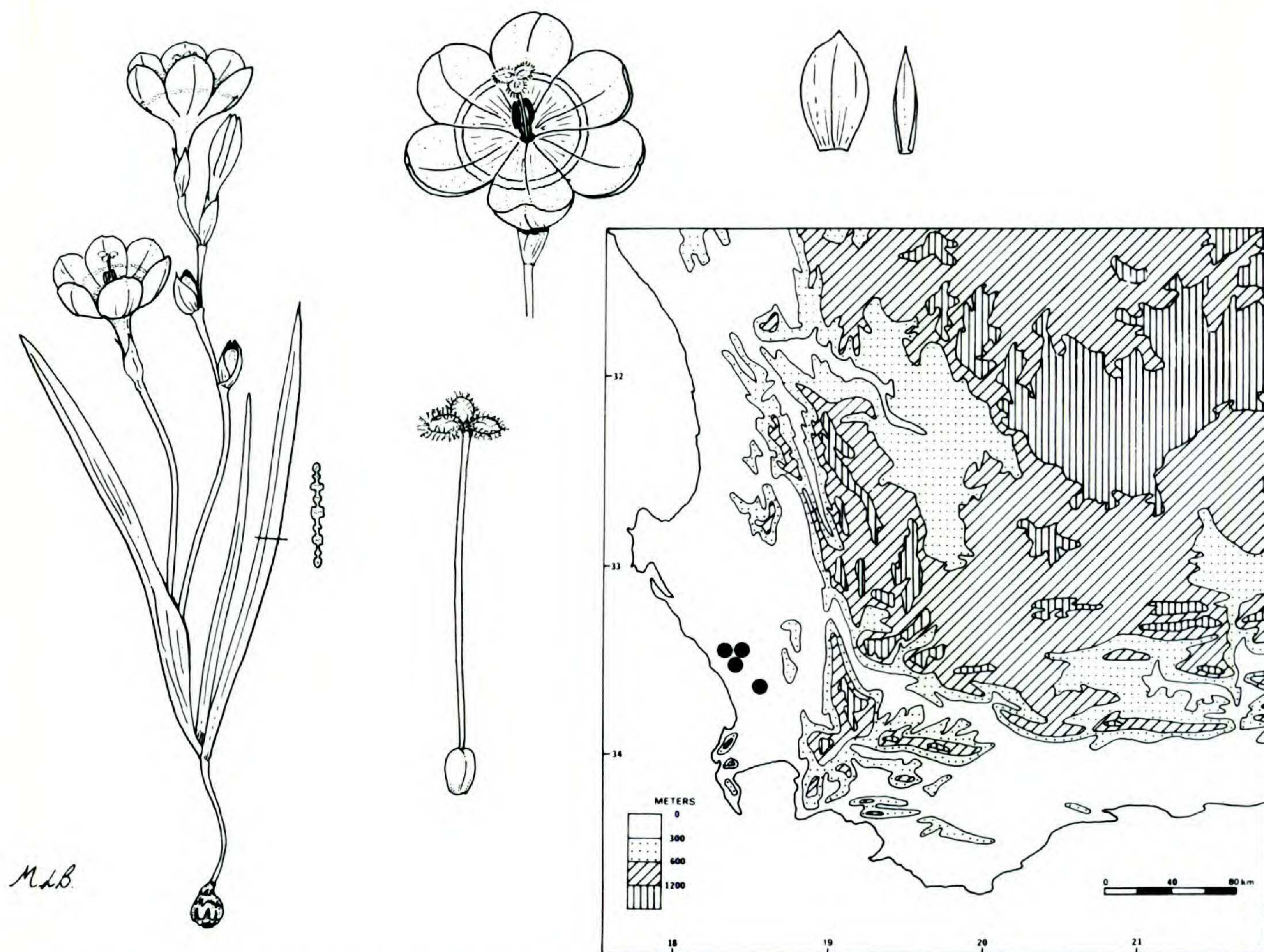


FIGURE 64. Morphology and distribution of *Geissorhiza eurystigma*. Habit $\times 0.5$; flower and separated bracts life size; gynoecium and leaf section much enlarged (*Burns s.n.*, farm Dassenberg, Kanonkop).

aments to 9 mm long, erect, equal; anthers 4.5–5.5 mm long, yellow. Ovary 2–3 mm long, style dividing near the apex of the anthers, branches 4 mm long, broad and heavily ciliate-pubescent. Capsule ovate-oblong, about as long as the bracts. Chromosome number, unknown.

Flowering time. September to early October.

Distribution. Western Cape coastal belt, centered around Darling and Mamre, and extending southeast to Kalabaskraal. Figure 64.

Geissorhiza eurystigma was first described in 1766 by Daniel de la Roche, who named it *Ixia secunda*. The type, in the Leiden Herbarium, is today still well enough preserved to make this identification certain (Goldblatt & Barnard, 1970). A year after the publication of *I. secunda*, Bergius (1767) described a second species (now *G. aspera* Goldbl.) also calling it *I. secunda*, and in the appendix to this work he cited de la Roche's *I. secunda*. While Bergius' species is today not

considered a validly published species, but merely a misapplied name, the eighteenth century botanical community either ignored the priority of de la Roche's species, or considered it and the better known Bergius plant conspecific (e.g., Thunberg, 1783), and the name was used widely for the small blue-flowered *G. aspera*.

Ker (1802a, 1802b) realized that *Ixia secunda* de la Roche was different from the species then bearing this epithet, but instead of applying the name *I. secunda* to what he believed was de la Roche's species, he renamed it *I. rochensis* and continued to use *I. secunda* in Bergius' sense. Ker included two species in *I. rochensis*, the filiform leaved plant figured in the "Botanical Magazine," now *G. radians* (long known as *G. rochensis*) and a variety (B) *spithamaea*, which in fact corresponds with de la Roche's *I. secunda*, now *G. eurystigma*. The two species are similar in flower form and color but *G. eurystigma* has broader, multi-ribbed leaves, broad flat ciliate

style branches and tepals which lack the white band and curious pits in the tepals characteristic of *G. radians*.

Robert Sweet realized that Ker's *Geissorhiza rochensis*, as figured in the "Botanical Magazine," was distinct from *Ixia secunda* de la Roche and in 1830 he renamed the latter *G. monantha*, citing a figure published by Houttuyn (1780) which is correctly named *I. secunda* de la Roche. In his catalogue of plants cultivated in Britain, Sweet (1830) also recognized Ker's *G. rochensis* (i.e., *G. radians*) as *G. rocheana*, indicating that he regarded the two as separate species. The name *G. monantha* is here considered a homonym of *G. monanthos* Ecklon. The two names have slightly different endings, one Greek and the other Latin, but they are certain to be confused and should not both be used in the same genus.

When *Geissorhiza eury stigma* was collected in the 1820s by Zeyher and then in the later nineteenth century by Templeman, it was again confused with the more common *G. radians* (*G. rochensis* sensu auct.) and robust plants of both species were referred to *G. rochensis* var. *spithamaea* Ker. Then in 1931 Louisa Bolus recollected the species and, believing that it was new to science, described it as *G. eury stigma*, a name referring to its unusual and conspicuous style branches. Foster (1941) regarded *Geissorhiza eury stigma* as a variety of the related *G. mathewsii*, a treatment not followed here. The differences between the two seem to me sufficiently great to merit separation at the species level, even though they share so unusual a character as their broad flat style branches. The two species are almost certainly closely allied. Both have relatively broad, ribbed leaves, deep blue flowers with a red center, and conspicuous broad flat style branches. The differences between the two species are discussed under *G. mathewsii*, the following species.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town), Mamre Hills (AD), *Barker* 1810 (BOL, NBG), 3834 (NBG), *Wasserfall* 436 (NBG), *van Niekerk* 272 (NBG), *Compton* 11765 (NBG); near Mamre (AD-CB), *L. Bolus* s.n. (BOL 19876), *Sidey* 2283 (S); Groene Kloof, *Zeyher* 295 in part (SAM 22086), *Templeman* sub *MacOwan* 2281 (M, SAM, Z); 4 mi. N of Mamre on Darling road, *Lewis* 1037 (SAM); between Mamre and Darling, *Lewis* 3634 (SAM), *Lamb* s.n. (K), *Gillett* 2074 (K); between Mamre and Darling at the turnoff to Mud River, *Goldblatt* 7266 (MO); first gate to Ganzekraal (CB), *Barker* 723 (NBG); Kalabaskraal (DA), *Werdermann & Oberdieck* 323 (B, GH, K, PRE), *Strey* s.n. (M); farm Dassenberg, N slopes of Kanonkop Range, *Burns* s.n. (MO).

WITHOUT PRECISE LOCALITY: Cape, *Anon.* s.n. "*Ixia secunda* de la Roche" (L), Herb. Burman s.n. "*Gladiolus junceus*" (G), *Masson* s.n. (BM).

58. *Geissorhiza mathewsii* L. Bolus, Ann. Bolus Herb. 4: 42. 1926; Foster, Contr. Gray Herb. 135: 27. 1941, excluding var. *eury stigma*. TYPE: South Africa. Cape: damp marshy places near Darling, *Mathews* s.n. flor. 1923 (lectotype, BOL 18502, here designated); *Mathews* s.n. flor. 1926 (syntype, BOL 18502). FIGURES 10, 65.

Plants 8–18 cm high. *Corm* globose, more or less symmetric, 7–10 mm diam., truncate at base, tunics imbricate, blackish, layers notched below into regular segments. *Cataphyll* membranous or evidently lacking. *Leaves* 3, the lower two basal, reaching to base or middle of spike, 2–4 mm wide, ensiform, conspicuously several ribbed, lowermost smallest, the third and uppermost leaf inserted at base or in lower part of stem, sheathing and inflated below, also several ribbed, longer and larger than lower leaves. *Stem* flexed above sheath of upper leaf, and at base of inflorescence, smooth, rarely bearing a bract-like leaf in upper half, simple or 1–3-branched. *Spike* secund, flexuose, 2–6-flowered; *bracts* herbaceous, green, becoming dry and membranous from apex, and often reddish on upper margin, 6–12(–15) mm long, inner about as long but narrow. *Flowers* actinomorphic, nearly stellate when fully open, deep blue, with a red center sometimes outlined in white; *perianth tube* short and slender, 2–3 mm long, included in the bracts; *tepals* 14–16 mm long, 9–10 mm wide, obovate, blue above, reddish in lower half. *Filaments* 6.5–8 mm long, erect; *anthers* ca. 4.5 mm long, articulated and horizontal, lying over the style branches, brown-purple. *Ovary* ca. 2 mm long; *style* dividing near the base of the anthers, branches 2–3.5 mm long, broad and flat, evidently smooth, concealed by the anthers. *Capsule* globose, to 16 mm long. *Chromosome number*, unknown.

Flowering time. Mid- to late September.

Distribution. The Darling area of the west coast in wet low lying situations. Figure 65.

Geissorhiza mathewsii is a rare local endemic of the Darling area of the southwestern Cape coast where it grows in wet, low lying areas. It is related to and often confused with *G. eury stigma*. The two have a similar appearance and broad, ribbed leaves, blue flowers with a red center, and the peculiar broad flat style branches,

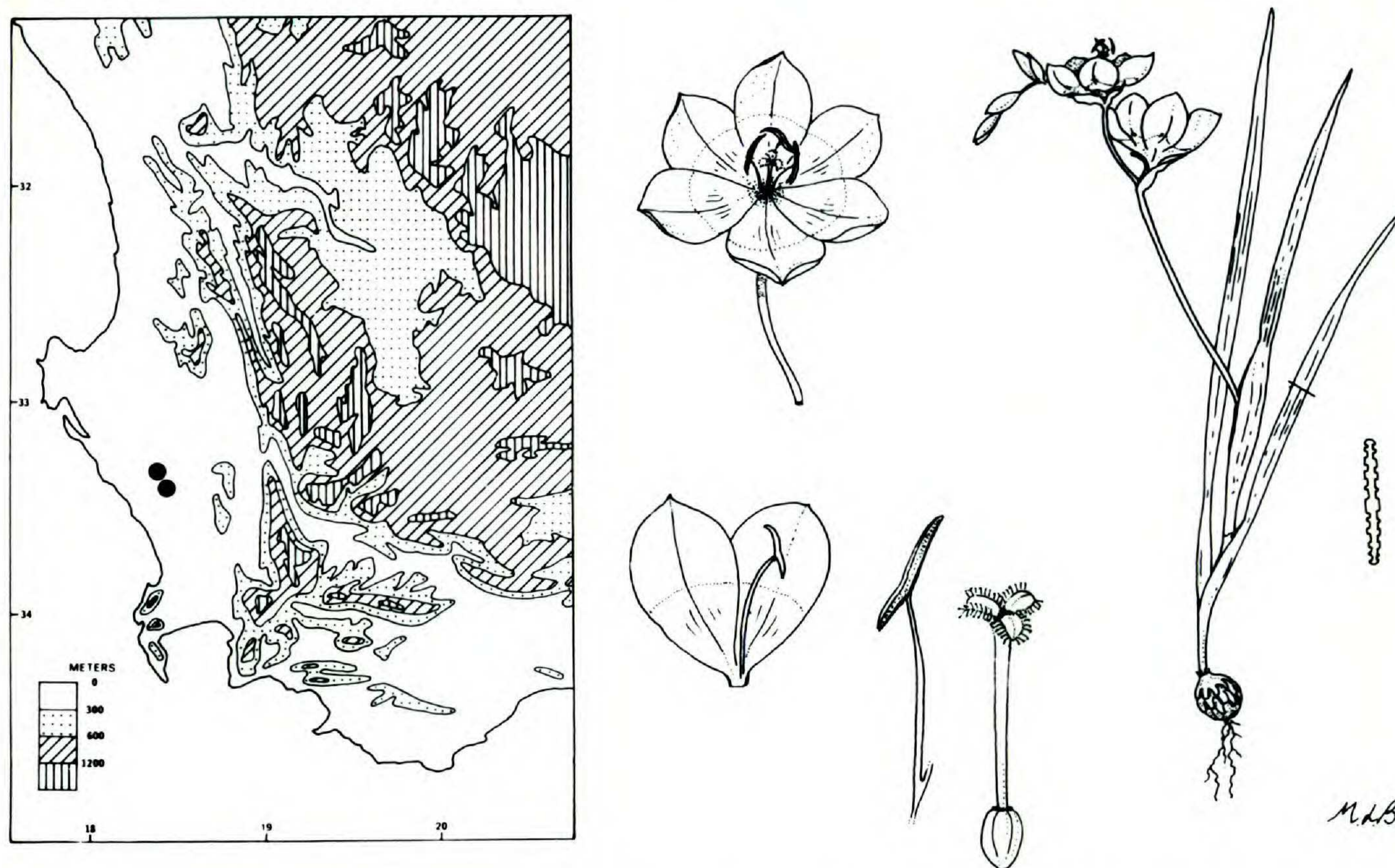


FIGURE 65. Morphology and distribution of *Geissorhiza mathewsii*. Habit $\times 0.5$; flower and separate tepals life size; gynoecium and anther $\times 2$; leaf section much enlarged (Goldblatt 7268, Waylands, Darling).

unique to these two species. Foster (1941) treated *G. eurystigma* as a variety of *G. mathewsii*, remarking that it differed primarily in its longer perianth tube, shorter filaments, and longer style. In this distinction Foster is only partly correct, *G. mathewsii* has a short tube, to 2.5 mm long and a shorter style but its filaments are shorter than those of *G. eurystigma*. However, there are other differences between the two and their treatment as separate is desirable. In addition to the short perianth tube, *G. mathewsii* has an altogether smaller flower with tepals to 16 mm long, whereas the tepals of *G. eurystigma* are up to 24 mm long. More significantly, the stamens and style are quite different. In *G. eurystigma*, the stamens are erect and held below the broad and heavily ciliate style branches, but in *G. mathewsii* the style divides near the base of the anthers which are articulated and lie horizontally when the flower is fully open, covering the nearly smooth style branches. The floral bracts also tend to be shorter than those of *C. eurystigma* and the lowermost leaf smaller than the others. The species is known from relatively few collections and is apparently very restricted in its distribution.

The distinctive flower coloring of *Geissorhiza mathewsii* and *G. eurystigma* is also found in *G.*

radians and in some forms of the unrelated *G. monanthos* (section *Planifolia*), and they may be sometimes be confused. *Geissorhiza radians* can be recognized by the pitted markings on the tepals, narrow leaves, and longer perianth tube and *G. monanthos* by its puberulous stem and smooth, flat leaves. Similarity of floral coloration in *G. monanthos* is most likely due to color mimicry, common in the southwestern Cape flora. *Geissorhiza mathewsii* grows together with *G. radians* and *G. monanthos* at some sites and the differences between their habitat preferences is then evident. *Geissorhiza radians* grows in the wettest places, often in standing water; *G. mathewsii* prefers slightly higher ground, but still in waterlogged soil; and *G. monanthos* occurs only in well-drained areas surrounding wet depressions.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Cape Town) "in humidis" near Darling (AD), *Mathews s.n.* (BOL 18502); near Darling, *Compton & Lamb s.n.* (Nat. Bot. Gard. 1332/31 in BOL); Oudepos, Darling, *Lewis 2236* (SAM); Mr. Basson's farm near Darling, *Barker 6764* (NBG); between Mamre and Darling, *Lamb s.n.* (K); Waylands farm, edge of vlei N of the railway line, *Goldblatt 7268* (K, MO, NBG, PRE), *Jarvis s.n.* (MO).

WITHOUT PRECISE LOCALITY: Malmesbury (? distr.), *Kassner s.n.* (B).

- 59. *Geissorhiza radians* (Thunb.) Goldbl.,** Nordic J. Bot. 3: 441. 1983. *Ixia radians* Thunb., Phytogr. Blätt. 1: 3. 1803. TYPE: South Africa. Cape: exact locality unknown, *Thunberg s.n.* [lectotype, Herb. Thunb. 982 UPS, designated by Goldblatt (1982); syntype, Herb. Thunb. 983 UPS = *Romulea* sp.]. FIGURES 11, 66.

Ixia rochensis Ker, Bot. Mag. 17: tab. 598. 1802, nom. illeg. superfl. pro *I. secunda* de la Roche (1766) = *Geissorhiza eurystigma* L. Bolus. *Geissorhiza rochensis* (Ker) Ker, Ann. Bot. (König & Sims) 1: 224. 1804, nom. illeg. basion. illeg. superfl.; Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 71. 1896 excl. var. *monantha*; Foster, Contr. Gray Herb. 135: 29. 1941.

Ixia larochei Roemer & Schultes, Syst. Veg. 1: 379. 1817, nom. superfl. pro *I. secunda* de la Roche = *G. eurystigma* L. Bolus. *Geissorhiza larochei* (Roem. & Schult.) Loudon, Hort. Brit. 1st edition, 16. 1830, nom. illeg. basion. illeg. superfl.

Geissorhiza rocheana Sweet, Hort. Brit. 1st edition, 399. 1827, Hort. Brit. 2nd edition, 503. 1830. TYPE: South Africa. Cape: without locality (illustration in Bot. Mag. 71: tab. 598. 1802).

Geissorhiza tulipifera Klatt, Abh. Naturf. Ges. Halle 15: 390 (Erg. 56) 1882. TYPE: South Africa. Cape: near Paarl, Drège 8486 (holotype, B, "Herb. Lubbeck"; isotypes, G, K, L, MO, P, S).

Geissorhiza cyanea Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 20. 1827, nom. nud. et ms. (Ecklon & Zeyher Irid. 219).

Geissorhiza rochensis var. *spithamaea* (Ker) Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 71. 1896 as to most specimens cited but excl. basion.; Foster, Contr. Gray Herb. 135: 29–30. 1941, pro parte (the type of var. *spithamaea* is *G. eurystigma* L. Bolus).

Rochea venusta Salisb., Trans. Hort. Soc. London 1: 322. 1812, nom. nov. pro *Ixia rochensis* Ker sensu Ker, nom. illeg. gen. illeg. non val. descr.

"*Geissorhiza radians* Gawl.," Nom. Bot. 2nd edition, 1: 668. 1840, in syn.

Plants 8–16 cm high. *Corm* globose, symmetric, truncate below, 6–9 mm diam., tunics dark, imbricate, notched below into regular rectangular segments. *Cataphyll* membranous pale. *Leaves* 3, linear, 0.5–1.5 mm wide, with thickened margins and enlarged midrib and 2-grooved on each surface, about as long, somewhat longer, or shorter than the stem, the lower two leaves basal, the upper inserted on lower part of stem, the sheath inflated and ribbed. *Stem* erect, flexed above the sheath of the upper leaf and at the base of the spike, simple or 1-branched. *Spike* 1–4 (–6)-flowered; *bracts* 8–13 (–16) mm long, herbaceous, the inner shorter than the outer. *Flowers* zygomorphic with the stamens declinate, the tepals widely cupped, deep blue with a red center

and narrow white band between, with a dark, excavated pit in the midline of each tepal; *perianth tube* 6–8 mm long, infundibuliform, exserted from the tube; *tepals* 15–22 mm long, obovate, 12–15 mm wide. *Filaments* ca. 10 mm long, equal, unilateral and declinate, held above the dorsal tepal, curving upward near the anthers; *anthers* unilateral, erect, 5–6 mm long, pollen red-brown. *Ovary* 2–3 mm long, *style* lying under the stamens, ca. 2 mm long, branches 4 mm, recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. September to early October.

Distribution. Flats in the western Cape coastal belt, from the Darling area south to Paarl and possibly to False Bay, damp sites in sandy soil, often of granitic origin. Figure 66.

This species is one of the most striking in the genus, and one of few, fairly widely known. It is occasionally found in cultivation and its large, deep blue flowers with contrasting white band around the red center make it worth the effort to maintain the plant in garden situations. As is the case with many species that have received botanical attention over a long period, it has a complex nomenclatural history. It is also unfortunate that the name it has been known by for over 150 years, *Geissorhiza rochensis*, is illegitimate (Goldblatt, 1983), so that this well-known species now has to carry the new name *G. radians* (Thunb.) Goldbl.

The type collection of *Geissorhiza radians* was made by Thunberg in the 1770s, although he only described the species years later in 1803, as *Ixia radians*. A year before, Ker (1802a) published *Ixia rochensis* as a new name for *Ixia secunda* de la Roche, but based on plants grown in England, and figured in the "Botanical Magazine." Ker mistakenly believed the figured species to be the same as the *Ixia secunda*, described in 1766 by Daniel de la Roche, but this is actually conspecific with the superficially similar *G. eurystigma* L. Bolus. Ker used the name *Ixia secunda* for a third species, the small, blue-flowered *G. aspera*, and so cited *I. secunda* de la Roche as a synonym of his *I. rochensis*. Ker's nomenclatural treatment is unacceptable and today *I. rochensis* is regarded as a superfluous and illegitimate name (Goldblatt, 1983). The next available synonym for the species figured by Ker is *Ixia radians* Thunberg, and the combination in *Geissorhiza* was made in 1983 (Goldblatt, 1983).

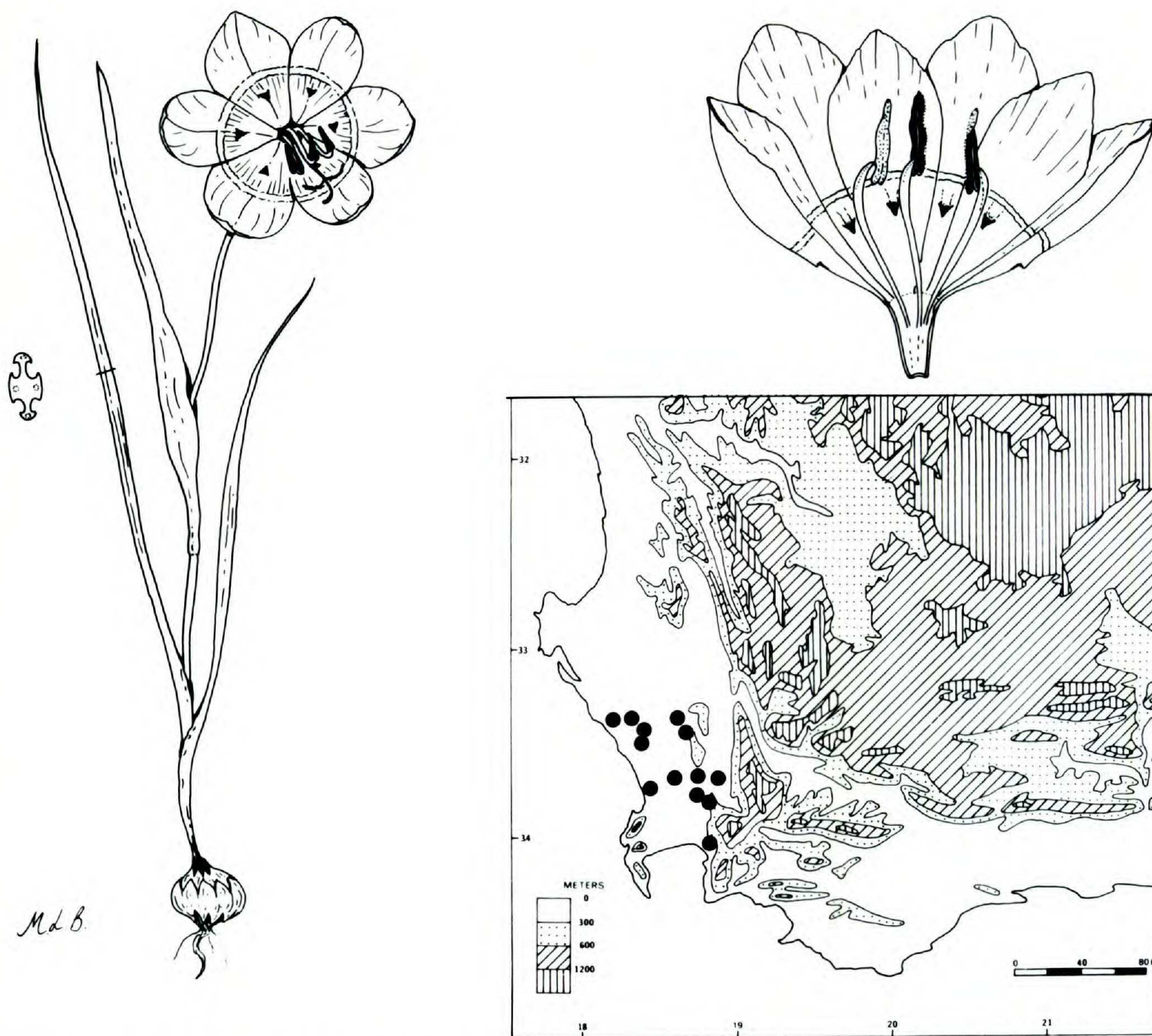


FIGURE 66. Morphology and distribution of *Geissorhiza radians*. Habit life size; opened flower $\times 1.5$; leaf section much enlarged (cultivated plant, hort. Kirstenbosch, no voucher).

Sweet (1830) seems to have been aware of this confusion and he renamed *I. secunda* de la Roche, *G. monantha*, and *G. rochensis* sensu Ker, *G. rocheana*. Other synonyms of *G. radians* include *G. tulipifera* Klatt, merely a later synonym, and *G. cyanea* Ecklon, a nomen nudum. Robust specimens of *G. radians* have often been referred to *G. rochensis* var. *spithamaea* by both Baker (1896) and Foster (1941). There is no character other than size to distinguish the plants to which they applied the name and no infraspecific taxon of *G. radians* is recognized here. The type of var. *spithamaea* Ker, Masson s.n. "*Ixia violacea*," in the British Museum is actually the closely related *G. eurystigma* (syn. *G. monantha* Sweet), which Ker regarded as a variety of his *G. rochensis*.

Geissorhiza radians was once fairly common along the Cape west coast, originally extending from False Bay in the south to the Malmesbury

district in the north. Its range is now much reduced due to expanding farming activity. This is unfortunately inevitable, as *G. radians* grows along streams and in wet flats in a rich agricultural area. It is protected to some degree in small reserves in the Darling area by local farmers, at least from direct ploughing, but alien plant species, animal grazing, and effects of fertilizer and weed killer runoff are gradually changing the environment, and this and many other lowland west coast species are becoming increasingly threatened.

Geissorhiza radians is distinctive in its blue and red flower coloration and peculiar pitted markings in the midline of its tepals as well as in its linear (sometimes almost terete) leaves with enlarged margins and midrib. Similarly colored flowers are found in *G. mathewsii* and *G. eurystigma*, both of which lack the pitted tepal mark-

ings and have broad, ribbed leaves. Some forms of the unrelated *G. monanthos* also have similarly colored flowers but this species has flat leaves and a puberulent stem.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Ysterfontein (AC), *Barker* 3844 (NBG); Groenekloof (AD), *Ecklon & Zeyher* 219 (66) (B, FI, G, MO), *Zeyher* 295 (SAM), *MacOwan s.n. in Herb. Norm. Austr. Afr.* 506 (B, BM, BOL, G, GH, K, SAM, W, Z); near Groenekloof, *H. Bolus* 4340 (BOL, K), *Pappe s.n.* (BM, K); near Darling, *H. Bolus* 12843 (BM, BOL, BR, Z), *Levy's* 3248 (K); Darling, *Guthrie* 2054 (NBG), *Stokoe s.n.* (SAM 69599), *Grant* 2527 (BOL, BR, M, MO, WAG), *Marloth* 9562 (STE); Darling Flora Reserve, *Barker* 8644 (NBG), *Lewis* 5068 (NBG), 5537 (NBG); 8 mi. W of Darling, *Strey s.n.* (M); Mamre Hills, *Wasserful* 437 (NBG), *Barker* 1806 (NBG), 3838 (NBG); between Mamre and Darling, *Lewis* 3634 (SAM); 3 mi. S of Darling, *Lewis* 1306 (SAM); streams near Malmesbury (BC), *Schlechter* 1610 (B, G, W, Z); Melkbos-Strand road (CB-CD), Spenglersdrift, near Klipheuwel (DA), *Thompson* 2597 (STE); Michiel Heyns, near Mamre Road, *Esterhuysen s.n.* (MO, PRE, S, US, WAG); 5.3 mi. NE of Klipheuwel Station, *Acocks* 20645 (NBG, PRE); Agterpaarl, damp sites (DB), *Loubser* 468 (NBG); near Paarl, *Drège* 8486 (B, BM, G, K, L, MO, P, S); Muldersvlei (DD), *Lewis* 4446 (SAM); damp place S of Bottelary road, *Acocks* 2162 (S).

3418 (Simonstown) Hottentots Holland (BB), *Ecklon & Zeyher Irid.* 292 (MO).

WITHOUT PRECISE LOCALITY: *Herb. Burman s.n.* "*Ixia secunda* Berg. Cap. 6" (G), *Oldenburg* 59 (BM).

SECTION MONTICOLA

10. Section *Monticola* Goldbl., sect. nov. TYPE: *G. burchellii* Foster.

Tunicae cormi durae et lignosae vel molles, foliis plerumque 3, ensiformibus ad linearibus vel teretibus planis vel marginibus costisque incrassatis, caule glabro, bracteis herbaceis supra interdum siccis membranaceis, floribus actinomorphae stellatis vel declinatis, tubo brevi vel longo, staminibus aequalibus vel inaequalibus.

Corm tunics hard and woody to fairly soft in texture, *leaves* ensiform to linear or terete, more or less plane or with the margins and midrib variously thickened, *bracts* herbaceous below, becoming dry above, *flowers* stellate to hypocrateriform, actinomorphic or declinate, the tube short or reaching to the apex of the bracts, stamens equal or more often strongly unequal.

Species. 9.

60. *Geissorhiza burchellii* Foster, Contr. Gray Herb. 135: 25–26. 1941. TYPE: South Africa. Cape: Langeberg near Zuurbraak, *Schlechter*

2160 (holotype, B; isotypes, B, BM, BOL, BR, PRE, Z). FIGURE 67.

Plants 12–20 cm high. *Corm* globose, tapering above, 7 mm diam., tunics light brown, more or less imbricate, papery in texture, cut below into narrow segments, drawn into points above. *Cataphyll* membranous, apparently solitary. *Leaves* 2–4, about half as long as the stem, occasionally about as long, 1.5–3 mm wide, the margins and midrib thickened and 2-grooved on each surface, often sticky and with soil adhering below, the lowermost leaf basal, the others inserted towards base and sheathing the stem for some distance above the ground, the uppermost sheathing for half its length. *Stem* erect, smooth, bearing in addition to a cauline leaf, 1–3 short, sheathing bracts, simple or 1–3-branched, flexed at the base of the inflorescence when in bud. *Spike* (1–)3–9-flowered, flexuose; *bracts* (6–)8–10 mm long, herbaceous, flushed red above. *Flower* stellate when fully open, the tepals sometimes becoming reflexed with age, pale to deep purple or violet, pale yellow in the throat and tube; *perianth tube* 4–6 mm long, cylindric, about as long or slightly longer than the bracts; *tepals* 12–18(–22) mm long, 5–6 mm wide. *Filaments* unequal, the two longer 10–14 mm long, the shorter 6–10 mm long; *anthers* yellow, 4–5.5 mm long. *Ovary* 1.5–2 mm long, *style* dividing near the apex of the anthers, branches ca. 4 mm long, recurved. *Capsule* more or less globose, 5–7 mm long. *Chromosome number*, $2n = 26$ (*Esterhuysen* 35363).

Flowering time. December to January.

Distribution. Mid to upper elevations in the Slanghoek, Hottentots Holland, Riviersonde- rend and Langeberg Mountains, between Bains Kloof and Heidelberg, blooming well only after fires. Figure 67.

Geissorhiza burchellii is an attractive but poorly known species of the western Cape mountains. It extends from the Slanghoek Mountains in the north to the Langeberg at Swellendam in the east and appears to grow at middle elevations on moist, often south-facing slopes. It flowers in the wild only after veld fires and in this character seems typical not only of the group of species to which it is allied but to most Cape mountain species of *Geissorhiza*.

It is related to *Geissorhiza grandiflora*, a species with a similar montane distribution and to the Cape Peninsula endemic *G. tabularis*, and is eas-

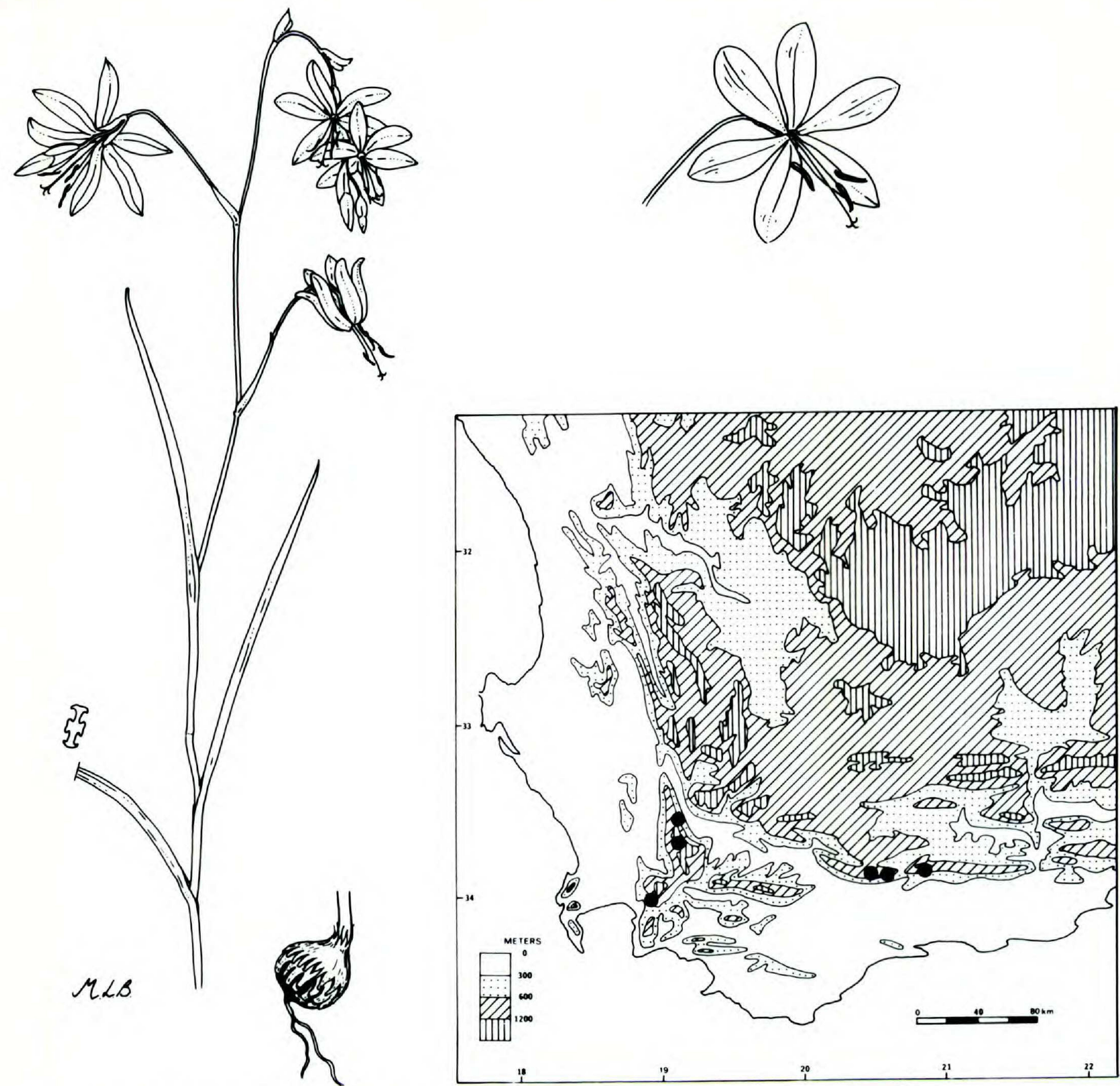


FIGURE 67. Morphology and distribution of *Geissorhiza burchellii*. Habit $\times 0.5$; flower and corms life size; leaf section enlarged (*Esterhuysen 35159*, Goedehoop Peak, Langeberg).

ily confused with these species as well as with the more widespread *G. ramosa*. All are montane species with characteristic branched stems; papery to woody, more or less imbricate corm tunics; leaves with slightly to heavily raised margins and midrib; and distinctly unequal stamens. *Geissorhiza ramosa* stands out in having very small flowers with a perianth tube 2–3 mm long, tepals 5–9 mm long and anthers 2–3.5 mm long. The flowers of *G. tabularis* have a similar short tube 1.5–2 mm long, but are larger, with tepals 15–18 mm long and anthers 3.5–5 mm long. The flowers of *G. grandiflora* are even larger with a tube 10–22 mm long, tepals 22–30 mm long and anthers 5–6 mm long. *Geissorhiza burchellii* has

flowers of intermediate size with a tube about 4–6 mm long, tepals 12–22 mm long and anthers 4–5.5 mm long. Its purple flowers and moderately long perianth tube give *G. burchellii* a very different appearance from the pale-flowered *G. tabularis* but it is easily confused with *G. grandiflora* and care must be taken in separating these two species.

A collection from Grassy Dome, Du Toits Kloof, *Jackson s.n.*, is tentatively assigned here. The single specimen lacks leaves and corm, but the flowers match those of *G. burchellii* well. Notes with sheet indicate that the flowers had white and dark red markings at the base of the tepals. Collections assigned here to *G. burchellii*

from near Caledon, *H. Bolus* 9891, and Landdrost Kop, *Stokoe s.n.* and *Thorne s.n.*, consist of plants within which the thickenings on the margins and midrib are poorly developed. In leaf morphology, these plants thus approach *G. grandiflora* but perianth tube and tepal length are nearly typical of *G. burchellii* and this is where they probably belong.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Landdrost Kop (BB), *Stokoe s.n.* (SAM 55712); E slopes of Landdrost Kop, *Thorne s.n.* (SAM 51559).

3319 (Worcester) Cossacks, Slanghoek Mts., 4,000 ft. (CA), *Esterhuysen* 24006 (BOL, K, PRE); Grassy Dome, Du Toits Kloof, *Jackson s.n.* (NBG 88252).

3320 (Montagu) Twelve O'Clock Peak, above Swellendam, below summit, 4,800 ft., after fire (CD), *Esterhuysen* 35363 (BOL, K, M, MO, NBG, P, PRE, S, US, WAG); Crown Mt., Swellendam, 3,800 ft., *Wurts* 542 (NBG); Boskloof hut, Swellendam hiking trail, 3,000 ft., after burning, *Esterhuysen* 35604 (K, MO, NBG, PRE, S, US, WAG); Langeberg near Zuurbraak, 3,300 ft. (DC), *Schlechter* 2160 (B, BM, BOL, BR, PRE, Z); Goedehoop Peak, Heidelberg, steep moist S slopes in burned area, 3,500–4,000 ft. (DD), *Esterhuysen* 35159 (BOL, K, MO, PRE, S, US); Langeberg above Grootvadersbos, 3,500–4,000 ft., *Esterhuysen* 18273 (BOL, K, NBG, PRE).

WITHOUT PRECISE LOCALITY: hills near Caledon, *H. Bolus* 9891 (BOL, K), *Burchell* 7322 (K).

- 61. *Geissorhiza grandiflora* Goldbl., sp. nov.**
 TYPE: South Africa. Cape: N side of Limietberg, Bains Kloof, ca. 4,000 ft., *Esterhuysen* 35832 (holotype, BOL; isotypes, C, E, K, MO, NBG, PRE, S, US, WAG). FIGURE 68.

Planta 16–35 cm alta, foliis (2–)3 inferioribus duobus basalibus linearibus, marginibus costisque incrassatis, caule erecto saepe ramoso, spica (1–)3–8 florum, floribus hypocrateriformibus roseis, tubo perianthii (10–)15–22 mm longo, tepalis 22–30 mm longis, filamentis inaequalibus declinatis 11–20 mm longis, uno 4–5 mm brevior quam aliis, antheris 5–6 mm longis.

Plants 16–35 cm high. *Corm* globose, 10–12 mm diam., tunics brown, more or less imbricate, woody, cut below into segments and drawn into short points above. *Cataphyll* membranous, apparently solitary. *Leaves* (2–)3, linear, 1.5–4 mm wide, with thickened margins and midrib, 2-grooved on each surface, sometimes sticky below and with soil adhering, the lower one to two leaves basal, reaching to about the base of the spike, the uppermost inserted on the lower part of the stem and sheathing for some distance. *Stem* erect, smooth, bearing in addition to the cauline leaf, 1 or 2 short sheathing bracts, simple or 1–3-branched, flexed at the base of the spike in bud.

Spike (1–)3–8-flowered, flexuose; *bracts* 13–16 mm long, herbaceous, flushed red above. *Flower* zygomorphic, the stamens and style declinate, deep pink with dark markings at the base of the tepals, pale in the tube; *perianth tube* (10–)15–22 mm long, cylindric, slightly longer to about twice as long as the bracts; *tepals* 22–30 mm long, 6.5–9 mm wide. *Filaments* unequal, unilateral and declinate, two 11–20 mm long, one 4–5 mm shorter than the others; *anthers* yellow, 5–6 mm long. *Ovary* 2–3 mm long, *style* dividing near the apex of the anthers, the branches 4–5 mm long, recurved. *Capsule* obovoid to globose, 5–8 mm long, enclosed in the bracts. *Chromosome number*, $2n = 26$ (Goldblatt 6828).

Flowering time. Late November to early January.

Distribution. Mid to upper elevations in the Slanghoek, Hottentots Holland, Riviersonde-
 rend and Langeberg Mountains, in rocky habitats. Figure 68.

Geissorhiza grandiflora is endemic to the mountains of the southwestern Cape. It has been collected on isolated high areas from Great Winterhoek Mountain and Bains Kloof in the north to the Langeberg at Swellendam in the east. The relatively few collections suggest that it flowers irregularly, perhaps only after mountain fires. It has one of the largest flowers in the genus, comparable in size with those of some species of section *Engysiphon* (subgenus *Weihea*). Despite its large and zygomorphic flowers with declinate stamens and style, unusual in section *Monticola*, *G. grandiflora* has the imbricate corm tunics, unequal stamens and branched stems characteristic of this section and is assigned here rather than to section *Engysiphon*. It resembles most closely the smaller flowered *G. burchellii*, a generally smaller species that can be distinguished by its leaves with heavily thickened margins and midrib and actinomorphic flowers with tepals in the 12–18(–22) mm range and a perianth tube 4–6 mm long. *Geissorhiza burchellii* is most common in the Langeberg, but has been recorded to the west in the Hottentots Holland and Slanghoek Mountains as well. The two species are occasionally sympatric or nearly so and both have been collected on the Cossacks, Slanghoek Mountains, by Elsie Esterhuysen at the same time some years ago.

A collection from Great Winterhoek, *Phillips* 1886, is tentatively assigned to *Geissorhiza grandiflora*. It appears to have somewhat smaller

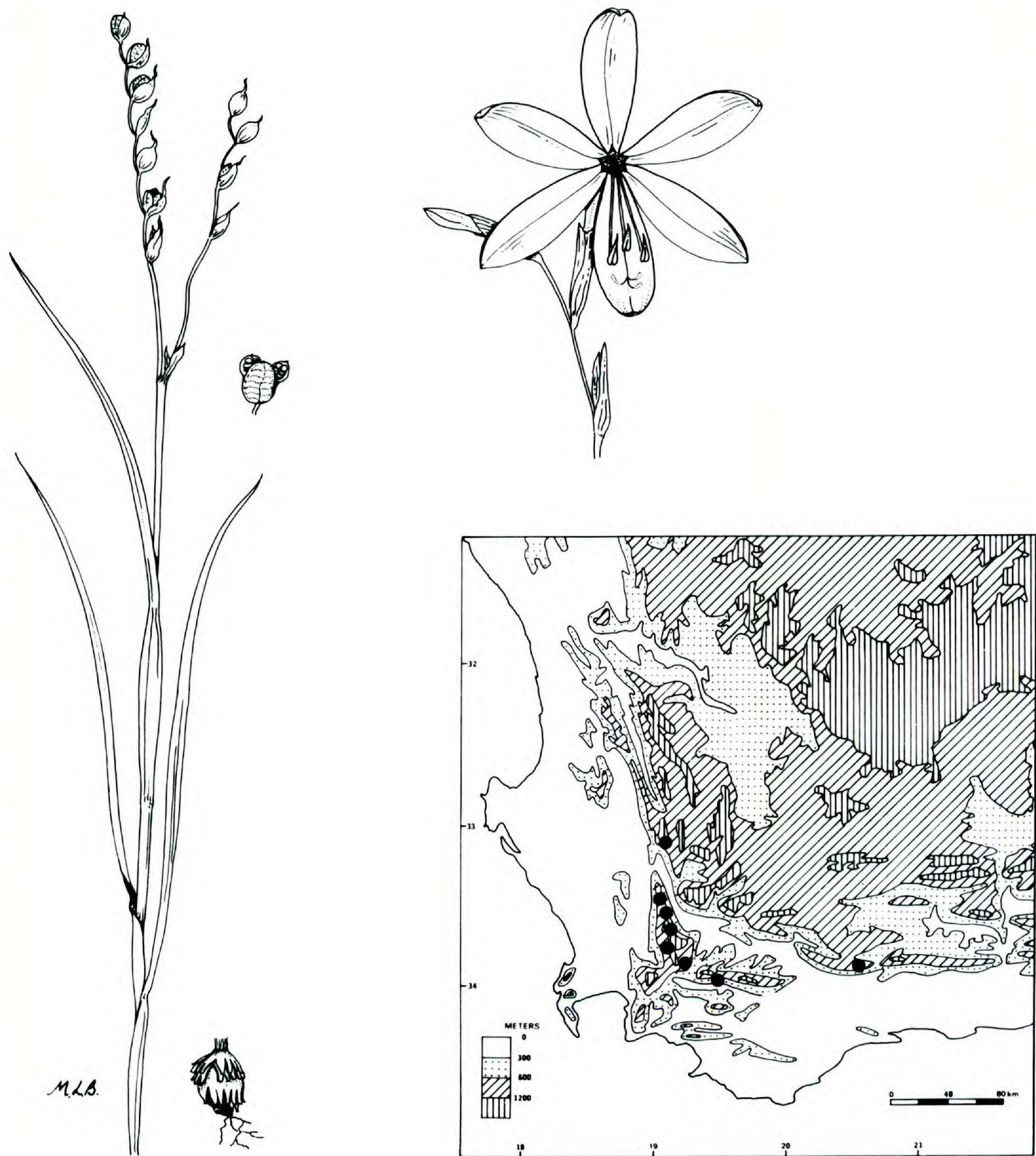


FIGURE 68. Morphology and distribution of *Geissorhiza grandiflora*. Fruiting plant and corm $\times 0.5$; spike with flower and enlarged capsule life size (fruiting Goldblatt 6828, flowering Esterhuysen 35832, both Limietberg, Bains Kloof).

flowers than are typical, but it is uncertain whether the poorly pressed blooms were incompletely open or shrunk excessively on drying, or whether this represents a form that normally has flowers with shorter tepals. Also included are collections from the Riviersonderend Mountains, *Esterhuysen* 35131, and the Langeberg, *Wurts* 543. These comprise plants with somewhat atypical flowers, seemingly larger and with a wider perianth tube.

The Esterhuysen collection clearly has yellow coloring in the throat of the flower. More collections from here are needed to determine whether this form represents a separate species.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Great Winterhoek, ca. 5,000 ft. (AA), *Philips* 1886 (SAM); Cossacks, Slanghoek Mts., 4,000 ft. (CA), *Esterhuysen* 23997 (BOL, K, MO, NBG); top of Baviaans Kloof off Bains Kloof, 3,000 ft., *Lewis* 770

or *s.n.* (BOL, NBG, PRE, SAM); N side of Limietberg, at the base and on a rocky slope, after a fire, *Esterhuysen* 35832 (BOL, C, E, K, MO, NBG, PRE, S, US, WAG), *Goldblatt* 6828 (MO, NBG, PRE); Haalsneeuwkop, 4,000 ft. (CC), *Stokoe s.n.* (SAM 56192); Wemmershoek Tafelberg, rugged slope, 5,000 ft., *Esterhuysen* 35863A (MO).

3320 (Montagu) Crown Mt., above Swellendam, 3,900 ft. (CD), *Wurts* 543 (NBG).

3419 (Caledon) Villiersdorp, near the new power station (AA), *Herre s.n.* (STE 8984); Kanonkop, E side of Genadendal valley, low wet cliffs, ca. 3,000 ft. (BA), *Esterhuysen* 35131 (BOL).

- 62. *Geissorhiza tabularis* Goldbl., sp. nov.** TYPE: South Africa. Cape: Table Mt., between Skeleton and Window Gorges, *Goldblatt* 6726 (holotype, MO; isotypes, K, NBG, PRE, S, US, WAG). FIGURE 69.

Geissorhiza ramosa (Ker) Klatt sensu G. J. Lewis, Fl. Cape Penins. 255. 1950.

Planta 25–35 cm alta, foliis (2–)3 inferioribus duobus basalibus linearibus marginibus costoque incrassatis, caule erecto, spica 3–8 florum, floribus stellatis malvinis, tubo perianthii ca. 1.5 mm longo, tepalis 15–18 mm longis, filamentis inaequalibus, longioribus duobus 5–6 mm longis, brevioribus 3–4 mm longo, antheris 3.5–5 mm longis.

Plants 25–35 cm high. *Corm* globose, tapering above, 7 mm diam., tunics light brown, more or less imbricate, papery in texture, cut below into narrow segments and drawn into points above. *Cataphyll* membranous, apparently solitary. *Leaves* (2–)3, linear, 2–3 mm wide, with slightly thickened to winged margins and midrib, and broadly 2-grooved on each surface, somewhat sticky below and with soil adhering, half to occasionally about as long as the stem, the lower two (or one) basal, the uppermost cauline, sheathing for half its length. *Stem* erect, smooth, bearing in addition to a cauline leaf, 1(–2) short, sheathing bracts, simple or 1–3-branched, flexed at the base of the inflorescence when in bud, later becoming straight. *Spike* 3–8-flowered, flexuose; *bracts* 7–8 mm long, herbaceous, flushed red above, recurved above at flowering time. *Flower* stellate when fully open, pale mauve to nearly white, usually becoming white after drying; *perianth tube* 1.5–2 mm long, cylindric, much shorter than the bracts; *tepals* 15–18 mm long, 5–7 mm wide. *Filaments* unequal, the two longer 5–6 mm long, the shorter 3–4 mm long; *anthers* 3.5–5 mm long. *Ovary* 1.5–2.5 mm long, *style* dividing at the apex of the anthers, branches ca. 2.5 mm, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (*Goldblatt* 6726).

Flowering time. Late October to mid-December.

Distribution. Restricted to the lower plateau of Table Mountain, in very wet or marshy situations in peaty sand, blooming rarely (if at all) except after fire. FIGURE 69.

This species, collected at least as early as 1825 by Ecklon and Zeyher, has long been confused with *Geissorhiza ramosa* Ker ex Klatt and it was so treated in “Flora of the Cape Peninsula” by Lewis (1950). Neither Foster (1941) nor Baker (1896) dealt with *Geissorhiza tabularis* and probably had no material of the species. It is endemic to Table Mountain on the Cape Peninsula and grows in wet or marshy sites. It flowers in the late spring or early summer only in the years following a veld fire.

Geissorhiza tabularis is related to the more common and widespread *G. ramosa* but is quite distinct from this species which typically has a more branched stem and many, much smaller flowers, the tepals of which are 5–9 mm long in contrast to the few branched *G. tabularis* in which the tepals range from 15–17 mm long. *Geissorhiza tabularis* seems close also to the widespread Cape mountain species, *G. burchellii*, which has large, purple flowers with a longer perianth tube to 5 mm and longer filaments, the long pair being 10–13 mm long and the short one, 5–8 mm. *Geissorhiza tabularis* has an unusually short perianth tube, 1.5–2 mm long and characteristically short filaments 3–6 mm long.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) S slopes of Table Mt. (CD), *H. Bolus* 3887 (BOL); Table Mt., top of Skeleton Gorge, burned last summer, *Esterhuysen* 10579 (BOL, K), *Compton* 16569 (BOL, NBG, STE, W); Table Mt. between Skeleton and Window Gorges, *Goldblatt* 6726 (K, MO, NBG, PRE, S, US, WAG); Table Mt., lower plateau above Kirstenbosch, *Lewis* 773 (PRE, SAM 56034); summit of Table Mt., *Zeyher s.n.* (SAM 20851); Groot Kop, shady S face, *Lewis* 4792 (SAM), *Compton* 19418 (BOL, NBG); Waai Vlei, *Wolley Dod* 2146 (BM, BOL, K in part).

- 63. *Geissorhiza ramosa* Ker ex Klatt, Linnaea 34: 657. 1866** (perhaps intended as a combination but no basionym cited and thus regarded as a new species); Foster, Contr. Gray Herb. 135: 24. 1941. *Geissorhiza secunda* var. *ramosa* (Klatt) Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 69. 1896. TYPE: South Africa. Cape: Tulbaghskloof, Tulbaghsthal, am Fuss des Winterhoeksberg, am Witsenberg und bei Vogelvalei, *Ecklon &*

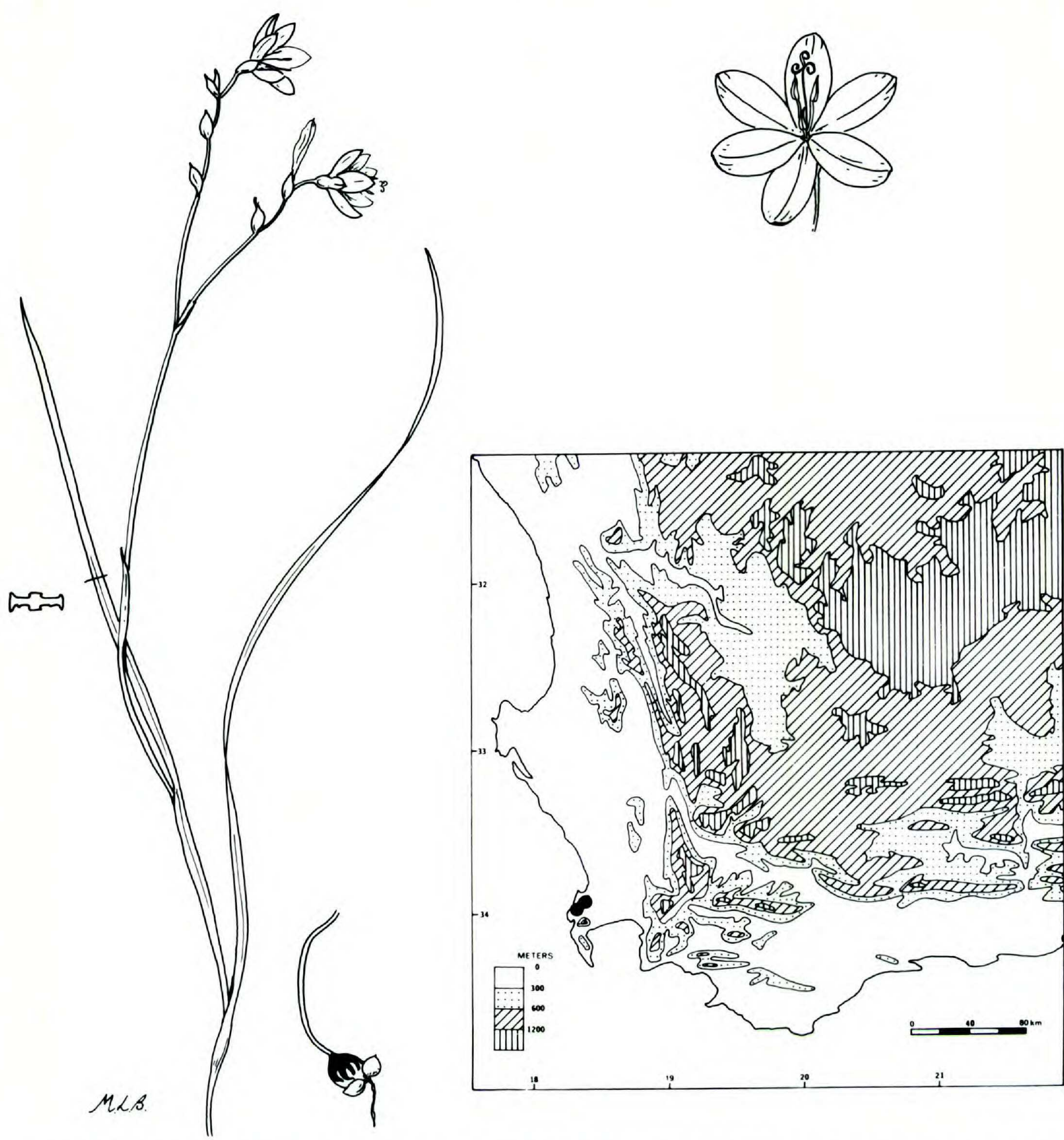


FIGURE 69. Morphology and distribution of *Geissorhiza tabularis*. Habit and corm $\times 0.5$; flower life size (Goldblatt 6726, Table Mt.).

Zeyher Irid. 229 (77.11) [lectotype, B, designated by Foster (1941); isoelectotypes, B, BM, E, FI, G, GH, L, LD, MO, P, PRE, SAM, W, Z], *Ecklon & Zeyher Irid.* 234 (syntype, not seen).

Geissorhiza montana Foster, *Contr. Gray Herb.* 135: 55. 1941. TYPE: South Africa. Cape: Genadendal Mts. at 3,000–4,000 ft., Drège s.n. “*G. imbricata* α ” (holotype, B; isotypes, BM, E, G, K, L, MO, S).

Plants 20–45 cm high. *Corm* globose, tapering above, 6–8 mm diam., tunics brown, woody or

more often more or less papery in texture, incised below into regular sections. *Cataphyll* membranous, solitary. *Leaves* 2–3(–4), linear, 1–2.5 mm wide, the margins and midrib thickened and narrowly 2-grooved on each surface, half as long, to about as long as the stem, the lower one or two leaves basal, the upper one (rarely two) cauline, and sheathing the stem below. *Stem* erect, smooth, with 2–4 branches (rarely simple), usually bearing 1 cauline leaf and short bracts in the axils of the branches. *Spike* few to several (to 11)-flowered, inclined, flexuose; *bracts* (3–)4–5.5

mm long, herbaceous, or becoming dry and membranous from the apex. *Flower* evidently stellate and actinomorphic (not seen live), blue, purple, or violet (fading to pink then white when dry); *perianth tube* short, 2–3 mm long; *tepals* (5–)7–9 mm long, 3–4.5 mm wide, obovate. *Filaments* unequal, the two longer 3–4 mm long, the other shorter by 0.5–1.5 mm; *anthers* 2–3.5 mm long, yellow. *Ovary* 1–2 mm long, *style* dividing towards the apex of the anthers, branches ca. 1.5 mm long, recurved. *Capsule* globose to oblong, 3.5–5 mm long. *Chromosome number*, unknown.

Flowering time. October to December (to January at high elevations).

Distribution. Mountains of the southwestern Cape from Groot Winterhoek in the north to the Langeberg near Riversdale in the east, often in marshy or wet sites; frequent after fires. Figure 70.

Geissorhiza ramosa is relatively common in the mountains of the southwestern Cape but it is not often collected, probably because it grows mainly at high altitudes and also due to its habit of flowering well only after fires. It is a most distinctive species and its normally branched stem; small, short-tubed flowers, and unequal stamens make confusion with other species unlikely. It is most closely related to the Cape Peninsula endemic, *G. tabularis* a species with much larger flowers, but a shorter perianth tube. The relationships of *G. ramosa* are discussed more fully under this species.

Specimens collected at Vogelgat near Hermanus, *Schlechter* 9577 and in Bains Kloof, *Grant s.n.*, are unusually short and have mostly unbranched stems and seem at first rather different from other collections of *G. ramosa*. The specimens match exactly the smaller individuals of collections such as *Esterhuysen* 33703, and there seems no reason to regard this material as anything but depauperate *G. ramosa*.

When Klatt described *Geissorhiza ramosa* he attributed the name to Ker, although as far as is known, Ker never knew this species. Klatt perhaps cited Ker in error or possibly intended to make a new combination based on *Ixia ramosa* Ker, but if so he neglected to cite a basionym, as was his normal practice. Given this situation, Foster (1941) suggested that *G. ramosa* be regarded as a new species described by Klatt, although he was aware that some 30 years later

Klatt (1895) cited *Ixia ramosa* Ker in the synonymy of *G. ramosa* when he subsequently dealt with this species. Foster suggested that after this period of time this action could not serve to indicate that *G. ramosa* was originally a new combination. I propose to follow Foster's treatment of *G. ramosa*.

Foster also recognized *Geissorhiza montana*, here included in *G. ramosa*. He knew this only from the type collection, a population of small plants, which he considered distinct from *G. ramosa*, on account of its crowded basal leaves "with a different type of venation" and soft, imbricate corm tunics. In fact plants of the type collection, *Drège s.n.* "*G. imbricata* a," have only two basal leaves, as in all the specimens he placed in *G. ramosa*, with margin and midvein only slightly less thickened than in those of other specimens. The corm tunics differ, in my estimation, hardly at all from many other collections of typical *G. ramosa*. *Geissorhiza montana* is therefore reduced to synonymy in *G. ramosa*.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Jonkershoek (DD), *Compton* 15310 (NBG).

3319 (Worcester) Winterhoekseberg (AA), *Ecklon & Zeyher Irid.* 227 (72.11) (B, LD, P); Witsenberg, Tulbagh (AC), *Zeyher* 1596 (B, FI, K, P, PRE, S, SAM, W, Z); Tulbagh ('Worcester, Tulbaghskloof'), *Ecklon & Zeyher Irid.* 229 (77.11) (B, BM, E, FI, G, GH, L, LD, MO, PRE, S, SAM, W, Z); Tulbagh Waterfall, *Esterhuysen* 16229 (BOL, NBG); mts. near Michells Pass (AD), *H. Bolus* 5246 (BOL, K); Du Toits Kloof (CA), *Drège* 8481a (B, G, K, L, MO), *Lewis* 3632 (MO, SAM), *Stokoe s.n.* (SAM 60127); suurvlaakte, N of Du Toits Kloof, damp mossy bank, *Esterhuysen* 12320 (BOL); Steenbokseberg, Bains Kloof, marshy stream bank near "Veepos," *Esterhuysen* 33703 (BOL, K, MO, S, US, WAG); Bains Kloof, *Grant s.n.* (LMU, MO, WAG); Witte River valley, Wellington, *Thorne s.n.* (SAM 46520), *Wasserfall* 619 (NBG), *Esterhuysen* 9430 (BOL); farm Eendracht, Waaihoek (CB), *Pica Survey s.n.* (PRE); mt. slopes S of Wemmershoek, 2,000 ft. (CC), *Phillips* 1309 (SAM); Adolph's Kop, French Hoek Mts., *Esterhuysen* 11198 (BOL, PRE); ridge from French Hoek Pass towards Paarde Kop, *Esterhuysen* 35862 (MO); Zachariashoek, Kalsteelkloof, *Smith* 46 (STE); Villiersdorp (CD), *Esterhuysen s.n.* (BOL 31883).

3320 (Montagu) forest path, below 10 O'Clock Mt., Swellendam (CD), *Wurts* 455 (NBG); Swellendam Mt., 2,500 ft., *Galpin* 4680 (K, PRE); Swellendam, above the town, 2,000 ft., *Taylor* 4228 (STE); Tradouw Pass (DC), *Barnard s.n.* (SAM 28495), *Galpin* 4679 (PRE).

3321 (Ladismith) Corente River farm, Riversdale (CC), *Muir* 5364 (PRE); 'Valley River, on the Lange Bergen near Kampscheberg, Riversdale Division,' *Burchell* 7044 (K).

3418 (Simonstown) Somerset Sneeukop (BB), *Stokoe s.n.* (SAM 49610); E slopes of Landrost Kop, Hot-

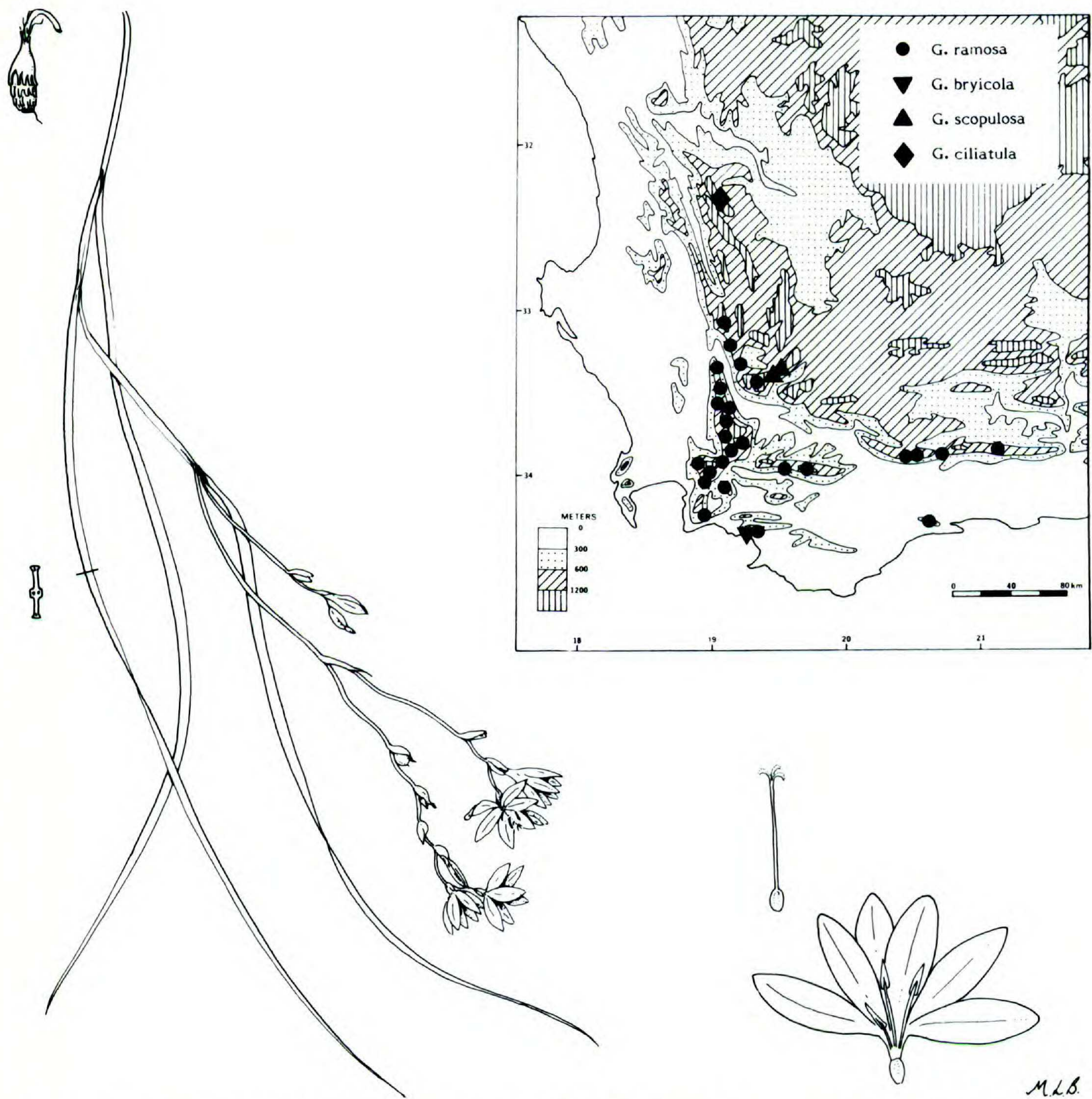


FIGURE 70. Morphology of *Geissorhiza bryicola* and distribution of *G. ramosa*, *G. bryicola*, *G. scopulosa*, and *G. ciliata*. Habit $\times 0.5$; flower and gynoecium $\times 1.5$ (Goldblatt 7032, Vogelgat, Hermanus).

tentots Holland, *Thorne s.n.* (SAM 51545); slopes above Steenbras Siding, *Thorne s.n.* (SAM 50416); Leopard Gorge, Betty's Bay, forest edge (BD), *Boucher 1704* (STE).
3419 (Caledon) Lebanon, burned area, 3,000 ft., *Kruger 227* (PRE, STE); Vogelgat (AD), *Schlechter 9577* (B, BM, BR, E, G, K, L, MO, P, PH, PRE, Z), *Goldblatt 6741* (MO); mts. above Genadendal (BA), *Drège s.n.* (B, BM, E, G, K, MO, S); Rivier Zonder End Mts. (BA-BB), *Stokoe s.n.* (SAM 57329); Pilaarkop above Lindeshof, path below summit, 4,500 ft. (BB), *Esterhuysen 35709* (K, MO, NBG, PRE, S, US, WAG).
3420 (Bredasdorp) limestone hills, Potteberg, De Hoop (AD), *Burgers 1197b* (PRE).
WITHOUT PRECISE LOCALITY: Caledon, *Pappe s.n.* (K); C. B. S., *Roxburgh s.n.* (BM).

64. *Geissorhiza bryicola* Goldbl., sp. nov. TYPE: South Africa. Cape: Vogelgat Nature Reserve, Hermanus, along the path at Psoralea Drip, *Goldblatt 7032* (holotype, MO; isotypes, K, NBG, PRE, S, WAG). FIGURE 70.

Planta 15–30 cm alta, cormo subgloboso, 5–8 mm diam., tunicis duro-membranaceis infra incis, foliis 3(–4), inferioribus duobus basalibus linearibus, caule reclinato interdum ramoso, spica 2–6 florum, bracteis herbaceis, 4–6(–8) mm longis, floribus stellatis albis, tubo ca. 2.5 mm longo, tepalis 8–10 mm longis, filamentis inaequalibus, longioribus 5–6 mm longis, brevioribus 3.5–5 mm longo, antheris ca. 3 mm longis.

Plants 15–30 cm high. *Corm* subglobose, symmetric, 5–8 mm diam., tunics brown, brittle-membranous, imbricate, incised below into regular segments. *Cataphyll* membranous. *Leaves* usually 3(–4), linear, weak and trailing, usually slightly longer than the stem, 1.5–4 mm wide, nearly flat, the midrib and margins lightly raised, the lower two leaves basal, the third inserted in the lower to mid part of the stem, partly sheathing, occasionally bract-like and with a short free apex, the fourth leaf if present, inserted in the upper part of the stem and short, more often reduced to a scale. *Stem* weak, inclined to trailing, simple or with 1 (occasionally 2) branches, bearing 1 short leaf and sometimes a second, often bract-like shorter leaf. *Spike* (2–)3–6(–10)-flowered, flexuose; *bracts* 4–6(–8) mm long, herbaceous, the upper margins transparent. *Flower* stellate, white; *perianth tube* short, ca. 2.5 mm long, usually just exerted from the bracts; *tepals* 8–10 mm long. *Filaments* unequal, the two longer 4–6 mm long, the shorter 3.5–5 mm long; *anthers* ca. 3 mm long, yellow. *Ovary* 2–2.5 mm long, *style* dividing at the apex of the anthers, branches ca. 1.5 mm long, recurved. *Capsule* globose, 3–5 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 6741), $26 + B$ (Goldblatt 6742).

Flowering time. September to mid-November.

Distribution. Klein River Mountains, in the vicinity of Hermanus, wet situations, in shade or on damp cliffs near seeps or waterfalls. Figure 70.

Geissorhiza bryicola grows in much the same habitat as *G. cataractarum*, which occurs along the slopes of the mountains between Hermanus and Bettys Bay some 30 km to the west. The two are, however, unrelated, and are treated here as belonging to different subgenera. *Geissorhiza bryicola* has smaller and white flowers (tepals 8–10 mm long) on spikes of 3–6 (occasionally to 10) flowers; unequal stamens; persistent, brown, imbricate corm tunic layers; and leaves with a nearly flat lamina. In contrast, *G. cataractarum* has large bluish flowers with tepals 14–20 mm long; spikes of 1–5 flowers; equal stamens; evanescent, pale evidently concentric corm tunics; and leaves with much thickened margins and midrib. *Geissorhiza bryicola* is closely related to the widespread western Cape mountain species *G. ramosa* and the two have similar flowers with short unequal stamens. *Geissorhiza ramosa* is a more robust species, usually with erect 2–

4-branched stems, spikes of up to 11 flowers and leaves with thickened margins and midrib. This combined with a purple to violet flower make it unlikely to be confused with the white-flowered *G. bryicola*.

Specimens examined. SOUTH AFRICA. CAPE: 3419 (Caledon) Fernkloof Nature Reserve, Hermanus, rock face in spray of waterfall, 200 m (AD), Robertson 132 (K, MO, NBG, PRE); Vogelgat Nature Reserve, along the path to Main Falls, Goldblatt 6742 (MO, NBG), 7037 (MO, PRE, S); Vogelgat, wet S-facing rocks at Psoralea Drip, Goldblatt 7032 (K, MO, NBG, PRE, S, WAG).

WITHOUT PRECISE LOCALITY: Hermanus Mts., *Stokoe s.n.* (SAM 55711); Klein River Mts., *Stokoe s.n.* (SAM 63476).

65. *Geissorhiza scopulosa* Goldbl., sp. nov. TYPE: South Africa. Cape: Hex River Mts., Milner Ridge Peak, 4,000–5,000 ft. (AD), Esterhuysen 9328 (holotype, BOL; isotypes, NBG, PRE).

Planta 6–15(–20) cm alta, foliis 3 inferioribus duobus basalibus linearibus, marginibus costoque incrassatis, caule erecto vel inclinato, spica 2–7 florum, floribus stellatis coeruleo-violaceis, tubo perianthii 2–3 mm longo, tepalis 8–9 mm longis, filamentis inaequalibus, longioribus duobus ca. 3 mm longis, brevior 2 mm longo, antheris 2–2.5 mm longis.

Plants (6–)8–15(–20) cm high. *Corm* globose, 8–10 mm diam., tunics brown, firm to soft-membranous, imbricate, regularly notched below. *Cataphyll* membranous, brownish above. *Leaves* 3, linear, 1–2 mm wide, the margins raised at right angles to the lamina, the midrib thickened, the lower two leaves basal, the lowermost longest, reaching at least to the base of the spike, sheath sticky and with sand adhering, second leaf sheathing the lower part of the stem for a short distance, the uppermost inserted in the upper part of the stem, short, sheathing for at least half its length, sometimes almost entirely. *Stem* upright or inclined, simple, minutely ciliate-papillose, bearing in addition to a cauline leaf, a sheathing bract in the upper third. *Spike* secund, flexuose, 2–5(–7)-flowered; *bracts* 3.5–5 mm long, green to membranous in bud, sometimes reddish above, becoming dry and pale in the upper part at flowering time. *Flower* stellate, pale violet blue, darkening in color with age, cream in the throat and tube; *perianth tube* 2–3 mm long, infundibuliform; *tepals* 8–9 mm long, ca. 3 mm wide, elliptic. *Filaments* unequal, the two longer ca. 3 mm long, the shorter 2 mm long; *anthers* 2–2.5 mm long, yellow. *Ovary* ca. 1 mm long,

style dividing near the apex of the anthers, branches ca. 1 mm long, recurved. *Capsule* globose, to 4 mm long, not exceeding bracts. *Chromosome number*, unknown.

Flowering time. November.

Distribution. Damp rocky sites, in cliffs and under boulders, usually south-facing, at high altitudes in the Hex River Mountains. Figure 70.

Geissorhiza scopulosa is very like *G. ramosa* in floral morphology and general appearance, although much reduced in size, and the two are almost certainly closely related. *Geissorhiza scopulosa* is restricted to the Hex River Mountains, an area where *G. ramosa* does not occur. It is apparently confined to rocky habitats at altitudes above 1,500 m. In addition to its smaller size, *Geissorhiza scopulosa* can be recognized by its unbranched stems, which are minutely ciliate, an unusual character in this section. Its reduced size and absence of branching make it seem likely that *G. scopulosa* is a local segregate of the very widespread *G. ramosa*.

Specimens examined. SOUTH AFRICA. CAPE: 3319 (Worcester) Hex River Mts., Milner Ridge peak, 4,000–5,000 ft. (AD), *Esterhuysen* 9328 (BOL, NBG, PRE); Milner Ridge Peak, S-facing cliffs, 5,000–6,000 ft., *Esterhuysen* 9333 (BOL, NBG); Baboon Peak, Hex River Mts., 4,800 ft., *Esterhuysen* 33337 (BOL).

66. *Geissorhiza ciliatula* Goldbl., sp. nov. TYPE: South Africa. Cape: Cedarberg, Middelberg, 1,500 m, *Goldblatt* 5144 (holotype, MO; isotypes, K, NBG, S).

Planta 6–12 cm alta, tunicis cormi imbricatis molibus, foliis (2–)3, inferiore basali falcato, marginibus costoque incrassatis, secundo basali caulem vaginanti in parte dimidio, superiore supra terram inserto vaginanti infra vel omnino, caule erecto ciliato, spica 1–4 florum, floribus stellatis albis postea purpurascensibus, tubo ca. 1.5 mm longo, tepalis 6–7 mm longis, filamentis aequalibus, antheris ca. 2 mm longis.

Plants 6–12 cm high. *Corm* globose, 3.5–5 mm diam., tunic layers brown, more or less imbricate, soft-textured, incised above and below. *Cataphyll* membranous, often fragmented. *Leaves* 3 or 2, linear to falcate, to 1 mm wide, oblong in section with margins and midrib strongly thickened, thus narrowly 2-grooved on each surface, the lowermost leaf basal, longest, the second also basal, but sheathing the lower half of the stem and free only above, the uppermost inserted on the upper third of the stem and sheathing for at least half its length (occasionally entirely

sheathing and bract-like). *Stem* erect, minutely ciliate, unbranched, flexed above the sheathing part of the upper leaf. *Spike* 1–4-flowered, flexuose; *bracts* 4–5 mm long, green below, membranous to dry and transparent above. *Flower* stellate, white, turning purplish on fading; *perianth tube* ca. 1.5 mm long, not exerted from the bracts, widening from the base; *tepals* 6–7 mm long, obovate, to 3 mm wide. *Filaments* equal, ca. 2.5 mm long; *anthers* ca. 2 mm long, yellow. *Ovary* ca. 1.5 mm long, *style* branching at the apex of the anthers, branches ca. 1.3 mm long, recurved. *Capsule* globose, 3–4 mm long, shorter than bracts. *Chromosome number*, $2n = 26$ (*Goldblatt* 5144).

Flowering time. November.

Distribution. Cedarberg, above 1,400 m, in sheltered wet mossy places on cliffs and cracks in rocks, mainly south-facing. Figure 70.

Geissorhiza ciliatula is a dwarf, white-flowered species from the Cedarberg and Cold Bokkeveld Mountains. In the Cedarberg it grows on the rocky peaks that rise above Middelberg Plateau. It grows in sheltered cracks in south-facing cliffs or under boulders, where shade and water are available late in the growing season. It occurs together with the very different and distinctive large pink-flowered *G. cedarmontana* in a habitat also shared with moss and *Drosera* sp., and occasionally *Hesperantha cedarmontana*, which flowers earlier in the season.

The exact nature of the corm tunics of *Geissorhiza ciliatula* is difficult to determine, as the tunics are soft-textured and not firmly fixed in position. However, they appear to be more or less imbricate and resemble those found in subgenus *Geissorhiza* section *Monticola*. Tentatively, I suggest that *G. ciliatula* may be related to the *G. ramosa* alliance, perhaps closest to the fairly small and also ciliate leaved *G. scopulosa* which occurs in similar habitats in the Hex River Mountains, some distance to the south.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) Cedarberg, S slopes of Middelberg Central (AC), *Goldblatt* 5144 (K, MO, NBG, S); Bokkeveld Sneeu Berg, 4,500–5,000 ft., seasonally damp narrow ledges below high cliffs (CD), *Esterhuysen* 36127 (BOL, K, MO, PRE, STE).

67. *Geissorhiza pseudinaequalis* Goldbl., sp. nov. TYPE: South Africa. Cape: Witteberg, Slanghoek Mts., wet overhung cliffs on S side, *Esterhuysen* 22293 (holotype, BOL; isotypes, K, MO). FIGURE 71.

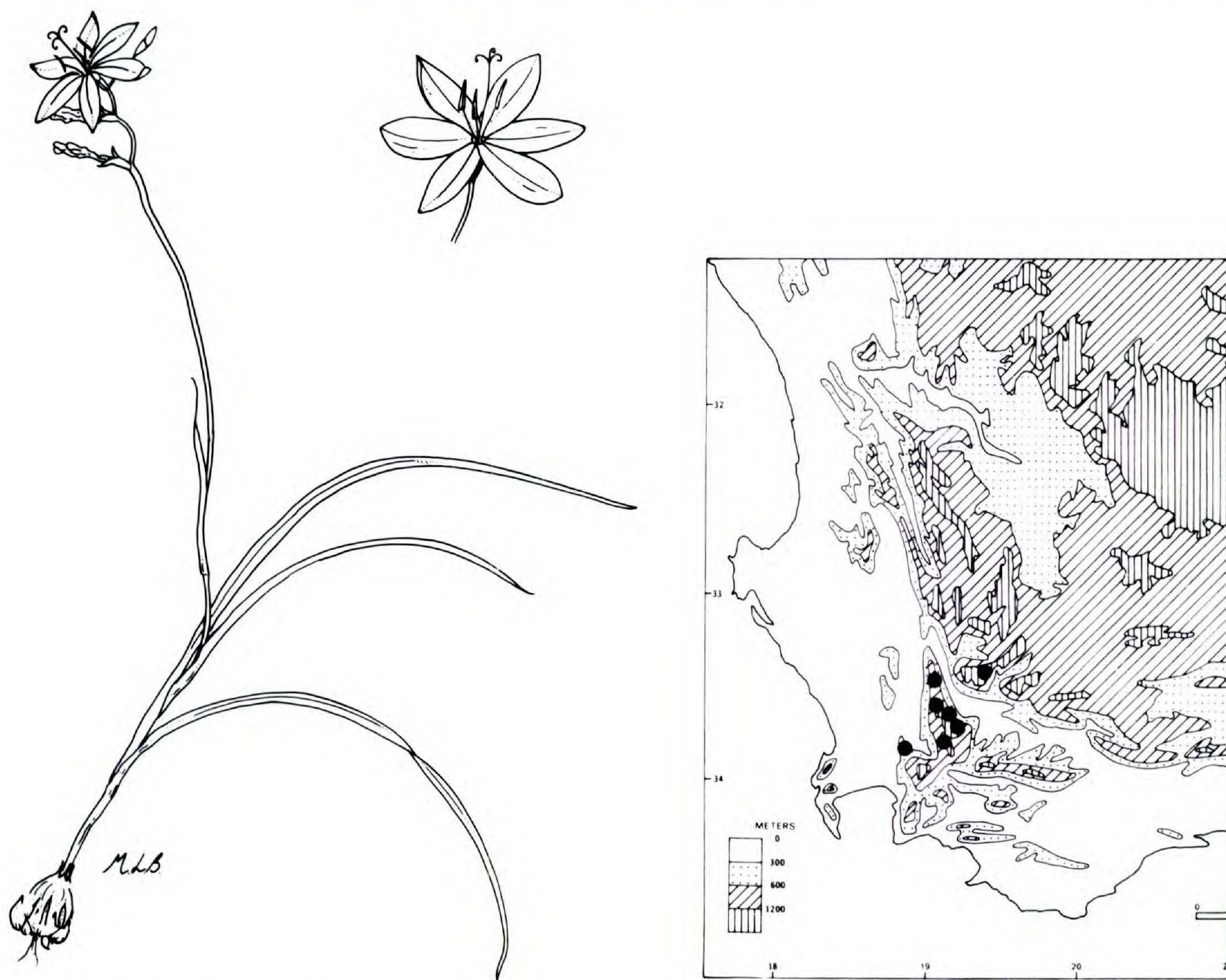


FIGURE 71. Morphology and distribution of *Geissorhiza pseudinaequalis*. Habit $\times 0.5$; flower life size (*Esterhuysen 35281*, Simonsberg).

Planta 9–18(–30) cm alta, tunicis cormi membranoso-papyraceis, imbricatis, foliis 3(–4) planis marginibus costoque parum incrassatis raro sparsim ciliatis, inferioribus 2(–3) basalibus, superioribus infra caulem vaginantibus, caule erecto, spica (2–)3–7 florum, floribus stellatis caeruleo-violaceis, tubo 3–5 mm longo, tepalis 12–17 mm longis, filamentis inaequalibus longioribus duobus 8–10(–12) mm longis, brevioribus 4–6 mm longo, antheris 3.5–5 mm longis.

Plants 9–18(–30) cm high. *Corm* globose, symmetric, 5–9 mm diam., usually heavily bulbiferous at base, tunics membranous-papery, more or less imbricate, incised below, light brown, the outer layers becoming irregularly broken. *Leaves* usually 3 (or 4), with a sheathing stem bract as well, linear, plane, the margins and midrib slightly raised, occasionally sparsely ciliate on the edges, 2–4 mm wide, usually about as long as the stem, the lower two (or three) leaves basal, the uppermost inserted in the lower to mid part of the stem, and sheathing below. *Stem* erect, smooth, bearing 1 or more sheathing, herbaceous bracts

in the upper part, and often branching at this point, and sometimes also from the axil of the upper leaf. *Spike* (2–)3–7-flowered, flexed at the base and flexuose; *bracts* 7–10 mm long, herbaceous, membranous on the upper margin, occasionally becoming dry above, and rarely somewhat tawny. *Flowers* stellate, blue to violet (or mauve) and usually pale in the tube, the throat sometimes ringed with darker color; *perianth tube* 3–5 mm long, not reaching the apex of the bracts; *tepals* 12–17(–20) mm long, obovate, 5–6.5 mm wide. *Filaments* unequal, the two longer 8–10(–12) mm long, the shorter 4–6 mm long; *anthers* 3.5–5 mm long. *Ovary* 2–3 mm long, *style* dividing near or beyond the apex of the anthers, branches recurved. *Capsule* unknown. *Chromosome number*, unknown.

Flowering time. Mid-October to January.

Distribution. Mid to upper elevations in the western Cape mountains between Ceres and Si-

monsberg, on damp, sheltered, south- or west-facing rock ledges and cliffs. Figure 71.

Geissorhiza pseudinaequalis is one of several species of *Geissorhiza* that occupy specialized niches in the southwestern Cape mountains. This species has a limited range from the Hex River Mountains and Bains Kloof to Simonsberg, and apparently grows in rocky places, on ledges, or cracks in cliffs where shade and moisture are available in mid summer, and it may bloom as late as January at higher elevations.

It has often been confused with *Geissorhiza inaequalis* (section *Planifolia*) on account of its markedly unequal stamens and flat leaves. The corms, however, are quite different, *G. inaequalis* having woody, imbricate tunics, smaller flowers and in addition, distinctively puberulent stems. *Geissorhiza pseudinaequalis* has papyraceous corm tunics, relatively large flowers and smooth stems. These two species are probably not closely allied and are here assigned to different sections of subgenus *Geissorhiza*. *Geissorhiza pseudinaequalis* is probably related to other montane species with similar soft-textured imbricate corm tunics such as *G. burchellii* and *G. tabularis*. These two species also have unequal stamens but differ in their larger size and leaves with strongly raised margins and midribs.

The single collection from the Hex River Mountains, *Esterhuysen 15882* at BOL, is mixed, and perhaps partly hybrid. It consists of a specimen of *Geissorhiza heterostyla* with its characteristic small flowers and brown stem bract, several specimens of *G. pseudinaequalis*, and some putative hybrids with flowers of intermediate size and partly brown stem bracts. The leaf margins and midrib of plants of this collection are minutely ciliate, also a feature of *G. heterostyla*.

Specimens examined. SOUTH AFRICA. CAPE: 3318 (Cape Town) Simonsberg, kloof on W side near Hellschoogte (DD), *Esterhuysen 35281* (BOL, K, MO, PRE).

3319 (Worcester) Prospect Peak, Hex River Mts., side of waterfall on E slopes (BC), *Esterhuysen 15882* (BOL, NBG, PRE); Bains Kloof, along road 2–3 mi. from hotel (CA), *Esterhuysen 32722* (BOL, PRE, S); Bains Kloof, *L. Bolus s.n.* (BOL 31895, 31909), *Johnson 1* (MO), *Barker 4279* (NBG), *Goldblatt 457* (BOL), 679 (BOL); Upper Wellington Sneekop, ledges on W side, *Esterhuysen 26546* (BOL, MO); Witteberg, Slanghoek Mts., wet overhung cliffs on S side, *Esterhuysen 22293* (BOL, K, MO); Witteberg, in horizontal and vertical cracks in S-facing ledges, *Esterhuysen 22293A* (BOL, K, PRE); kloof between Molenaarsberg and Witteberg, Du Toits Kloof, *Esterhuysen 24150* (BOL); mts. S of Wemmershoek (CC), *Andreae 821* (PRE).

SECTION *PLANIFOLIA*

11. Section *Planifolia* Goldbl., sect. nov. TYPE: *G. aspera* Goldbl.

Tunicae cormi durae lignosae, foliis plerumque 3, ensiformibus ad linearibus planis, caule puberulo-ciliato, bracteis infra herbaceis supra siccis ferrugineis, floribus actinomorphae stellatis vel declinatis, tubo brevi, staminibus aequalibus vel inaequalibus.

Corm tunics, blackish, hard and woody, *leaves* usually 3, blade plane and smooth, lanceolate to ensiform, rarely linear, *stem* puberulous-ciliate, *bracts* herbaceous below, dry and ferrugineous in the upper half, *flowers* stellate and actinomorphic or declinate, the tube short, stamens equal to unequal.

Species. 4.

68. *Geissorhiza aspera* Goldbl., J. S. African Bot. 36: 303. 1970. TYPE: South Africa. Cape: Rondebosch common, *Goldblatt 501* (holotype, BOL; isotypes, K, NBG, PRE). FIGURE 72.

Ixia secunda de la Roche sensu Berg., Pl. Cap. 6, 360. 1767; sensu Thunb., Diss. de *Ixia* no. 7. 1783 non *I. secunda* de la Roche (= *G. eurystigma* L. Bolus).

Ixia secunda Ker sensu Ker, Bot. Mag. 17: tab. 597. 1802 (November), hom. illeg. (type of *I. secunda* de la Roche specifically excluded), et nom. superfl. pro *I. pusilla* Andr. (1802, August).

Geissorhiza secunda Ker, Ann. Bot. (König & Sims) 1: 224. 1804; Baker, Handb. Irid. 154. 1892, Fl. Cap. 6: 69. 1896, excl. vars.; Foster, Contr. Gray Herb. 135: 41. 1941 [as *G. secunda* (Berg.) Ker]. TYPE: (illustration in Bot. Mag. 17: tab. 597. 1802).

Gladiolus junceus Burm. f., Fl. Cap. Prod. 2. 1768, nom. nud.

Plants 8–35 cm high. *Corm* ovoid-globose, 3–6 mm diam., tunics dark, often blackish, imbricate. *Leaves* usually 3, flat, linear to ensiform, erect to falcate, the margins and midrib slightly raised, smooth or sparsely puberulent-ciliate, about as long as the stem or somewhat longer, 2–5(–7) mm wide, the lower two basal, the upper basal or inserted shortly above the ground and sheathing the lower part of the stem. *Stem* inclined or erect, simple, more often 1–3-branched, densely puberulent (rough to touch), usually bearing a short leafy bract from the upper node. *Spike* (1–)2–7-flowered, usually flexed below the first flower and secund; *bracts* herbaceous below, dry and brown in the upper half, 6–12 mm long, spreading above, the inner smaller, 6–8 mm long. *Flower* stellate, usually deep blue to purple, occasionally white or pale bluish; *perianth tube* 1–



FIGURE 72. Morphology and distribution of *Geissorhiza aspera*. Habit $\times 0.5$; corm and flowering spike life size (Goldblatt 6274, Commonage at Malmesbury).

2 mm long, infundibuliform; *tepals* 11–15 mm long, 4–6 mm wide. *Filaments* 3–5 mm long, one sometimes shorter by up to 1 mm; *anthers* erect, 3–5.5 mm long, white to pale yellow. *Ovary* 1.5–2 mm long, *style* 7–8 mm long, branches to 2 mm long. *Capsule* 5–6 mm long, ovoid to rotund. *Chromosome number*, $2n = 52$ (Goldblatt 213, 520, 4839A, *s.n.* no voucher, St. James, Cape Peninsula), $2n = 26$ (Goldblatt 5350, 5647, *s.n.* no voucher, Burghers Pos, Darling).

Flowering time. August to September.

Distribution. Widespread, Cape Peninsula east to the Langeberg at Tradouw Pass and north into the Olifants River Valley as far as the Doorn River and Gifberg. Figure 72.

Geissorhiza aspera is a common southwestern Cape species. It is most often found on sandy soils, but also light clay or granitic ground, both on mountains and flats, and it typically grows in large numbers. It is persistent and is often one

of the last survivors of the native flora after severe disturbance. Plants vary greatly in size, depending on soil fertility and the amount of moisture available, and may grow well over 30 cm high, or be stunted and less than 10 cm. The flowers are deep glistening blue to mauve in the southwestern Cape, but occasional white mutants occur, sometimes even in pure colonies. It is more frequent in the south, in the Caledon district, on the Cape Peninsula and locally to the north, around Darling and Malmesbury, but it extends north through the Olifants River Valley and Cedarberg Mountains to the Gifberg Mountains near Van Rhynsdorp. Here *G. aspera* is more variable, and plants with white to pale bluish flowers rather than the typical dark blue-purple are frequent. In the north of its range plants are often found in sheltered sites, sometimes in the lee of rocks or on moister south trending slopes. The stamens are often described as being equal (Foster, 1941), but careful examination of live

plants shows that one filament is usually slightly shorter, and in populations in the north of its range the filaments are distinctly unequal. *Geissorhiza aspera* is unusual in the genus in being heteroploid with both diploid, $2n = 26$, and polyploid, $2n = 52$, populations. From the sample of seven populations so far counted, there is a pattern of diploids in the north of the range and tetraploids in the south, but both cytotypes have been recorded on the Cape Peninsula.

Geissorhiza aspera is closely allied to *G. inaequalis*, a more robust species, which has large pale blue-mauve flowers. It shares with *G. aspera* the characteristic puberulous stem and broad flat leaves. In *G. inaequalis*, the short filament is about half as long as the others and the bracts are green to membranous during flowering and unlike the typical dry, brown-tipped bracts of *G. aspera*.

The nomenclature of this common species is unfortunately complex and confusing. Its history begins when Bergius published a description of a plant he called *Ixia secunda* in his "Plantae Capensis" in 1767, based upon specimens in his collection in Stockholm. However, in the addendum to this work he cites *I. secunda* de la Roche (1766), in effect, but perhaps not by intention as a synonym. Bergius' *I. secunda* is regarded here as having no nomenclatural validity, but is merely a misapplied name. *Ixia secunda* de la Roche is the species currently known as *G. eurystigma* (Goldblatt, 1983). De la Roche's study of Cape Iridaceae, published in 1766, was largely misunderstood by contemporary and succeeding botanists and the name *I. secunda* was usually applied to plants matching Bergius' description and specimens (e.g., Thunberg, 1783; Ker, 1802a, 1802b), and this situation led to considerable nomenclatural confusion when the two species named *Ixia secunda* were transferred to *Geissorhiza*.

Ker, who actually understood that *Ixia secunda* de la Roche and *I. secunda* sensu Bergius were different species, published descriptions and illustrations of both in Curtis' "Botanical Magazine." He renamed what he thought was *I. secunda* de la Roche (i.e., the earlier epithet) *I. rochensis*, citing of course *I. secunda* de la Roche as a synonym. This name is therefore, nomenclaturally superfluous. It has, unfortunately, been applied in Ker's sense ever since to the well known Cape species, now to be called *G. radians* (Thunb.) Goldbl.

Ker (1802b) named the small, blue-flowered

and pubescent stemmed plant *Ixia secunda* citing, of course, *I. secunda* sensu Bergius, but excluding de la Roche's species. According to current rules of nomenclature, Ker's *I. secunda* is a new name and a homonym for *I. secunda* de la Roche. It is also superfluous, since *I. pusilla* Andr. was cited as a synonym. Upon transfer to *Geissorhiza*, *G. secunda* cannot be treated as a legitimate new name in terms of article 72.2 as it is still superfluous, *I. pusilla* not having been excluded when the transfer was made. The new name *G. aspera* was provided by myself (Goldblatt & Barnard, 1970) for *G. secunda* Ker and as the only legitimate synonym, the name must be used for this well known Cape plant (Goldblatt, 1983).

Specimens examined. SOUTH AFRICA. CAPE: 3118 (Van Rhynsdorp) near Doorn River bridge, old road between Clanwilliam and Van Rhynsdorp (DC), Goldblatt 3866 (MO); Gifberg, Compton 20848 (NBG), Barker 9594 (NBG, UC), Phillips 7523 (NBG, in part), 7520 (NBG); Gifberg, E slopes of plateau, Esterhuysen 21947 (BOL); Nardouw Kloof (DD), Stokoe s.n. (SAM 59842); Bulshoek Barrage, Barker 9062 (NBG).

3218 (Clanwilliam) between Graafwater and Lamberts Bay (AB-BA), L. Bolus s.n. (BOL 23185); 9 mi. S of Clanwilliam (BB), Lewis 5209 (M, NBG); Clanwilliam, Loubser 938 (NBG); Olifants River Dam, Clanwilliam, Steyn 513 (NBG); 10 mi. N of Clanwilliam (BB), Barker 3613 (NBG); 20 mi. N of Citrusdal, Olifants River Valley, Lewis 1033 (SAM); Kransvlei Berg, Barker 5338 (NBG); pass over Kransvlei Mts., Lewis 1870 (SAM); 8 mi. S of Clanwilliam, Goldblatt 266 (BOL); 14 km S of Clanwilliam, Goldblatt 2472 (MO, US); between Clanwilliam and Algeria, Goldblatt 2569 (MO, PRE, S); Olifants River Valley, N of Rondegat, Goldblatt 5647 (MO, NBG, S, US, WAG); Kapteins Kloof (DA), van Niekerk 636 (BOL); Modderfontein, Olifants River (DB), Diels 209 (B); Greys Pass, Lewis s.n. (K), Hafstrom & Acocks 298 (PRE, S); near Piketberg (DC), Barnes s.n. (BOL 31899), Barker 7564 (MO, NBG); Levant Peak, Marloth 11528 (BOL), Esterhuysen s.n. (MO).

3219 (Wuppertal) Pakhuis Pass (AA), Bond 590 (NBG); Middelberg, Cedarberg, shady rocky crevices (AC), Compton 6613 (NBG); Cedarberg, Uitkyk Pass, Gillett 4113 (MO); Warm Baths (CA), Leipoldt s.n. (BOL 31901); Waterfall River, Citrusdal, Barker 3775 (NBG); Platkloof, Hanekom 1236 (STE).

3318 (Cape Town) near Hopefield (AB), Bachmann 217 (Z); Darling (AD), Bachmann 519 (B), near Darling, Stokoe s.n. (SAM 49601), Grant 2532 (MO); 4 mi. N of Mamre, Lewis 1040 (SAM); Groenekloof, Zeyher s.n. (SAM 20838, 20839), Ecklon & Zeyher Irid. 228 (B, SAM), MacOwan 2165 (K, SAM), H. Bolus 4338 (BOL, K); Mamre Hills, Barker 1475 (NBG); Waylands, Darling, Barker 807 (NBG); veld near Darling, Lewis 2532 (MO); Moorreesburg (BA), Bachmann 1089 (B, Z); Tulbagh road near Porterville (BB), Wilman 715 (BOL); Porterville, Steyn 583 (NBG); Malmesbury commonage, on S slope of hill (BC), Gold-

blatt 6274 (MO, WAG); flats N of Hermon (BD), *Goldblatt* 6411 (MO); Bok Point (CB), *Barker* 806 (NBG); Hof Str, Cape Town (CD), *Page* s.n. (BOL); Signal Hill, *Penfold* s.n. (SAM 52898), *Barker* 406 (NBG), 703 (NBG), *Wilms* 3739 (B), *Dümmer* 886 (E), *Salter* 531 (K); Lions Head, *MacOwan* s.n. (SAM), *Marloth* 7394 (PRE), *Schlechter* 1579 (B, FI, G, W, Z); Signal Hill, W slopes, *Goldblatt* 213 (BOL), Camps Bay, lower slopes, *Cassidy* 250 (BOL); lower Blinkwater, *Cassidy* 12 (BOL, NBG); near Rosebank, *H. Bolus* 4804 (BOL, K); W slopes of Orange Kloof, *Wolley Dod* 3453 (BOL); Rondebosch common, *Goldblatt* 501 (BOL, K, NBG, PRE); Camp Ground, *H. Bolus* 4609 (BM, BOL, GH, K, Z); Bergplatze bei Capstadt, *Ecklon & Zeyher Irid.* 228 (64.9) (B, FI, G, GH, L, LD, MO, W, Z); slopes of Table Mt., *MacOwan in Herb. Norm. Aust. Afr.* 807 (B, BM, BOL, G, SAM, Z); Table Mt., *Zeyher* 5034 (SAM), *Ecklon* 310 (B, BM, E, G, K, M, S, Z), *Rogers* 16973 (PRE, Z); Salt River, *Zeyher* 70 (BOL, SAM); near Wellington (DB), *L. Bolus* s.n. (BOL 31900), *Moss* 4307 (J); Paarl Mt., *Henderson* 1184 (NBG), *Drège* 8483a (B, BM, G, K, L, MO); between Paarl and Pont, *Drège* s.n. (SAM 20842), *Drège* 8483c (B, G, K, L, MO); Dal Josaphat, *Grant* 2340 (BOL, MO, P); Langverwacht, above Kuils River (DC), *Oliver* 4710 (PRE, STE); Jonkershoek Valley (DD), *Lewis* 1611 (SAM); Swartbos Kloof, Jonkershoek, *Lewis* s.n. (SAM 58954); Klapmuts, *Lewis* 4451 (NBG); Stellenbosch, *Prior* s.n. (K), *Garside* 1067 (K).

3319 (Worcester) lower slopes, Great Winterhoek Mts. (AA), *Thorne* s.n. (SAM, PRE); Tulbagh (AC), *Kassner* 1306 (BR, E), *Garside* 1544 (K); Lakenvlei (BC), *Barker* 1474 (NBG); Bains Kloof (CA), *Lotsy & Goddijn* 879 (L); French Hoek Pass (CC), *Werdemann & Oberdieck* 381 (B, K, PRE), *Boucher* 2347 (K, PRE).

3320 (Montagu) foot of Tradouw Pass (DC), *Marsh* 878 (STE).

3418 (Simonstown) Simonstown (AB), *Wolley Dod* 582 (BOL); between Witsands and Redhill, *Lewis* 1074 (SAM); Chapmans Peak, *van Niekerk* 465 (NBG); Redhill, W slopes, *Barker* 5912 (NBG); Simons Bay, *Wright* s.n. (K, L); Grasslands Kloof, Cape Point Reserve (AD), *Taylor* 8620 (STE); Cape Flats (BA), *MacOwan* s.n. (SAM 48596), *Krauss* 1394 (MO), *Rehmann* 1837 (BM, BR, Z), *Marloth* 7261 (PRE); Helderberg (BB), *Parker* 4257 (GH, K, NBG, PH, PRE); Sir Lowrys Pass, *Schlechter* 1579 (B); near Somerset West, *Ecklon & Zeyher Irid.* 226 (B, FI, K, LD, MO, SAM); Pringle Bay, Hangklip (BD), *Gillett* 4204 (BOL); Palmiet River mouth, *Gillett* 4241 (BR, LD, MO); Kogel Bay, *Werdemann & Oberdieck* 288 (B, BR, K, PRE, WAG).

3419 (Caledon) 8 mi. N of Bot River (AA), *Goldblatt* 293 (BOL); quarry above Onrus (AC), *Horocks* 19 (MO); Albertyn-Caledon road, Avontuur farm, *Goldblatt* 4981 (MO); Hemel-en-Aarde (AD), *Gillett* 1403 (BOL, STE); Fernkloof, Hermanus, *Goldblatt* 5178 (MO, PRE), *Orchard* 281 (BR, E, K, STE); Vogelklip, Hermanus, *Barker* 1788 (NBG); Stanford, *Gillett* 4449 (BR, MO); Genadendal (BA), *Kogel* s.n. (B); Fransche Kraal, Waterfall (CB), *Barker* 7554 (NBG); Groot Hagelkraal, limestone boulders and cliffs (DA), *Oliver* 6142 (PRE, STE); The Poort, Bredasdorp (DB), *Dymond* s.n. (BOL 31899); roadside between Hermanus and Stanford, *Gillett* 4512 (BOL, PRE);

3420 (Bredasdorp) near Bredasdorp (CA), *Sidey* 1831

(MO, S); Swellendam, Buffeljagsrivier, farm Middenplaas (BA), *Vlok* 325 (MO).

WITHOUT PRECISE LOCALITY: Cape of Good Hope (CBS), *Lalande* s.n. (B, P), *Lichtenstein* s.n. (B), *Bergius* s.n. (B), *Mund & Maire* s.n. (B), *Harvey* 867 (E), 876 (E), *Commerson* s.n. (G), *Niven* s.n. (BR), *Verreaux* s.n. (G), *Bowie* 403 (G), *Alexander* s.n. (BR, Z), *Thunberg* s.n. (S, UPS), *Grondal* s.n. (S); "Olifants R. bei villa Brakfontein," *Ecklon & Zeyher Irid.* 213 (76) (B, SAM); banks of Olifants River, *Schlechter* 5029 (B, BM, BR, E, G, GH, K, P, S, STE, Z); Herb. Burman s.n. "*Gladiolus junceus*" (G); Olifantsrivier, *Penther* 666 (Z), 679 (Z).

69. *Geissorhiza inaequalis* L. Bolus, S. African Gard. 20: 346. 1930; Foster, Contr. Gray Herb. 135: 45–46. 1941. TYPE: South Africa. Cape: Klipkoppies 6 mi. from Nieuwoudtville, *L. Bolus* s.n. (lectotype, BOL 19256, here designated; isoelectotypes, BM, BOL, K). FIGURE 73.

Plants 12–25 cm high. *Corm* ovoid-globose, 6–8 mm diam., tunics dark, often blackish, imbricate, bearing several cormlets around the base. *Leaves* usually 3, flat, ensiform, erect to falcate, margins and midrib slightly raised, smooth, shorter to somewhat longer than the stem, 4–10 mm wide, the lower two leaves basal, the third basal or inserted above the ground and sheathing for some distance. *Stem* more or less erect, simple or 1–3-branched, lightly papillose-puberulent, usually bearing a short leafy bract from the upper node. *Spike* 2–7-flowered, usually flexed below the first flower and secund; *bracts* herbaceous below, drying and becoming pale and membranous above, rarely brownish at apex, 10–15(–18) mm long, spreading in the upper half, the inner bract shorter than the outer. *Flower* stellate, pale blue-mauve, whitish in the center; *perianth tube* 2–3 mm long, infundibuliform; *tepals* 20–23 mm long, 4–6 mm wide. *Filaments* unequal, the two longer 8–10 mm long, the shorter 5–6 mm long, nearly horizontal and initially more or less unilateral; *anthers* inclined to horizontal, 5–6 mm long, one sometimes slightly shorter, white. *Ovary* 2–3 mm long, *style* dividing near the apex of the anthers, branches ca. 3 mm long, recurved. *Capsule* oblong, 5–8 mm long, ca. 3.5 mm wide, shorter than the bracts. *Chromosome number*, $2n = 52$ (*Goldblatt* 129, 275).

Flowering time. Late August to early October.

Distribution. Heavy soils in the Nieuwoudtville district, often in rocky situations. Figure 73.

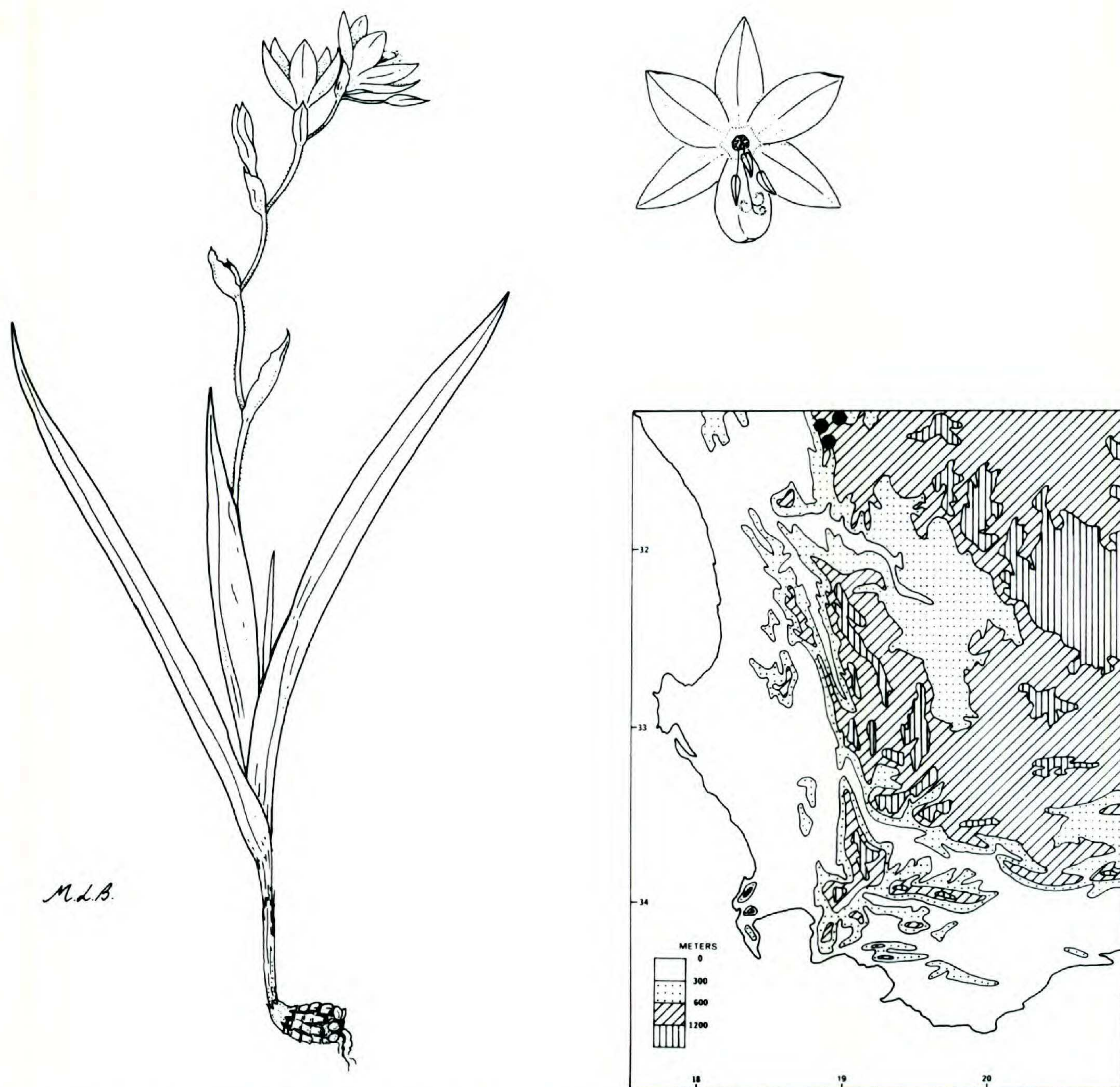


FIGURE 73. Morphology and distribution of *Geissorhiza inaequalis*. Habit $\times 0.5$; flower life size [Nieuwoudtville Reserve (ex hort.), no voucher].

Geissorhiza inaequalis is most closely related to the very common and widespread *G. aspera* (syn. *G. secunda*) and it is sometimes difficult to distinguish them when dry. Both have a similar habit, flat ensiform leaves and puberulent stems. *Geissorhiza aspera* typically has deep blue-violet, less often whitish, flowers and at flowering time the upper parts of the floral bracts are often dry and rusty brown. It usually has equal or subequal stamens, but populations with one shorter stamen are not uncommon. In contrast, *G. inaequalis* has larger, pale blue-mauve flowers, typically green or pale, membranous bracts at flowering time, the brown coloration developing only after the flowers fade. It also has one filament

about half as long as the others and even one anther may be slightly shorter than the other two. In *G. inaequalis*, the stamens are inclined to horizontal and nearly unilateral while they are erect and symmetrically disposed in *G. aspera*. *Geissorhiza inaequalis* may also be confused with *G. heterostyla* L. Bolus [syn. *G. rosea* (Klatt) Foster], which is similar in habit, and has one short filament. The latter, however, has leaves ciliate on raised margins and midrib, usually a glabrous stem and it typically has a short dry bract leaf in the upper part of the stem. Dry material must be examined carefully to avoid misidentification.

The species is unusual in the genus in being tetraploid, $2n = 52$. It is restricted to heavier soils

in the Nieuwoudtville district where it occurs at the edge of the Karoo, often in rocky sites.

Specimens examined. SOUTH AFRICA. CAPE: 3119 (Calvinia), Klipkoppies, ca. 6 mi. from Nieuwoudtville (AC), *L. Bolus s.n.* (BM, BOL 19256, K); Glenlyon farm, Nieuwoudtville, *Oliver & Mauve 30* (PRE, STE); near the top of Van Rhyns Pass, *Goldblatt 269* (BOL); Grasberg road, 4 mi. from Nieuwoudtville, *Goldblatt 275* (BOL); 5 mi. from Nieuwoudtville, *Barker 9560* (NBG); Nieuwoudtville Reserve, among dolerite boulders in red clay, *Perry & Snijman 2360* (NBG); Uitkomst farm, SW of Nieuwoudtville (CA), *Barker 10733* (NBG).

70. *Geissorhiza monanthos* Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 21. 1827; Baker, Fl. Cap. 6: 71. 1896, in syn. sub *G. rochensis*; Foster, Contr. Gray Herb. 135: 39. 1941 [as *G. monantha* (Thunb.) Ecklon]. *Ixia monanthos* Thunb., Fl. Cap. 1st edition (Uppsala), 226. 1811, Fl. Cap. 2nd edition (Copenhagen), 123–124. 1818 (or 1820), hom. illeg. non de la Roche (1766) (= *Sparaxis* sp.). TYPE: South Africa. Cape: exact locality unknown, *Thunberg s.n.* [lectotype, Herb. Thunb. 975 UPS, designated by Goldblatt (1982)]. FIGURE 74.

Geissorhiza bellendenii MacOwan, J. Linn. Soc., Bot. 25: 393. 1890; Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 72. 1896. TYPE: South Africa. Cape: Groen Kloof, *MacOwan s.n. in Herb. Norm. Austr. Afr. 810* (lectotype, SAM; isoelectotypes, B, BM, BOL, G, K, S, SAM).

Geissorhiza rochensis var. *monantha* (Sweet) Baker sensu Baker, Handb. Irid. 156. 1892, Fl. Cap. 6: 71. 1896, excl. basion.

Geissorhiza lewisiae Foster, Contr. Gray Herb. 135: 45. 1941. TYPE: South Africa. Cape: Langebaan, *Lewis s.n.* (holotype, Herb. Bolus 20303 in K; isotype, BOL), syn. nov.

N.B. *Geissorhiza monantha* Sweet (1830) is a different species, based on a different type. It is regarded here as a homonym of *G. monanthos* and is currently known as *G. eury stigma*.

Plants (6–)10–20 cm high. *Corm* globose, symmetric, 5–10 mm diam., usually with many cormlets around the base, tunics imbricate, blackish, layers notched below into regular segments. *Cataphyll* membranous, often evidently lacking. *Leaves* 3–4, more or less erect, linear to ensiform, plane with the midrib distinct, (1–)2.5–4 mm wide, usually slightly shorter than the stem, the lower two leaves basal, the upper cauline, decreasing in size and sheathing below, the uppermost sometimes bract-like, smooth entirely or ciliate to pubescent along the margins and sometimes other main veins. *Stem* erect, flexed

at the base of the spike, minutely puberulous, simple or 1–2-branched. *Spike* 1–4(–5)-flowered, flexuose; *bracts* (8–)10–12 mm long, herbaceous in bud, becoming dry and brown above as the flowers open, folded outwards in the upper part, the inner slightly smaller than the outer. *Flower* either dark blue-violet and pale yellow in the center and the tube or sometimes red in the lower part of the tepals, stellate or slightly cupped, zygomorphic with upper tepal tilted downwards, and stamens declinate, held above upper tepal, the style lying under the stamens; *perianth tube* ca. 2 mm long, cylindric; *tepals* obovate, 14–18 mm long, 9–12 mm wide. *Filaments* 6–8 mm long, usually equal, rarely one slightly shorter, declinate, held above the upper tepal; *anthers* unilateral, red-brown or yellow, 4.5–5.5 mm long. *Ovary* ca. 2 mm long, *style* decumbent, lying below the stamens, branching at mid anther level, branches recurved. *Capsule* ovate, 7–8 mm long, enclosed in the bracts. *Chromosome number*, unknown.

Flowering time. Late August to mid-October.

Distribution. Southwestern coastal belt from the foot of the Hottentots Holland Mountains to the Vredenburg-Saldanha area, with outlying populations in the Olifants River Valley near Citrusdal: on sandy or rocky soils, mostly of granitic origin, sometimes growing in cracks in granite rocks. Figure 74.

This relatively common and conspicuous west coast *Geissorhiza* has been known at least since it was collected by Thunberg in the 1770s. It remained undescribed until 1811 when the first edition of Thunberg's "Flora Capensis" was published. Unfortunately the name Thunberg selected, *Ixia monanthos*, was a homonym for a species described in 1766 by Daniel de la Roche, and hence illegitimate. Ecklon's (1827) combination in *Geissorhiza*, based on the Thunberg species can however be regarded as a new name from 1827 [Botanical Code article 72(1), Stafleu 1978)]. Thus the fairly well known name *G. monanthos* can be preserved in its current sense. Much later, in 1890, MacOwan described *G. bellendenii* quite independently, based on plants he collected near Mamre, at Groene Kloof. At the time MacOwan was evidently unaware of the existence of the name *G. monanthos* for this species, and was concerned in drawing attention to the differences between his plant and *G. radians* (then known as *G. rochensis* Ker).

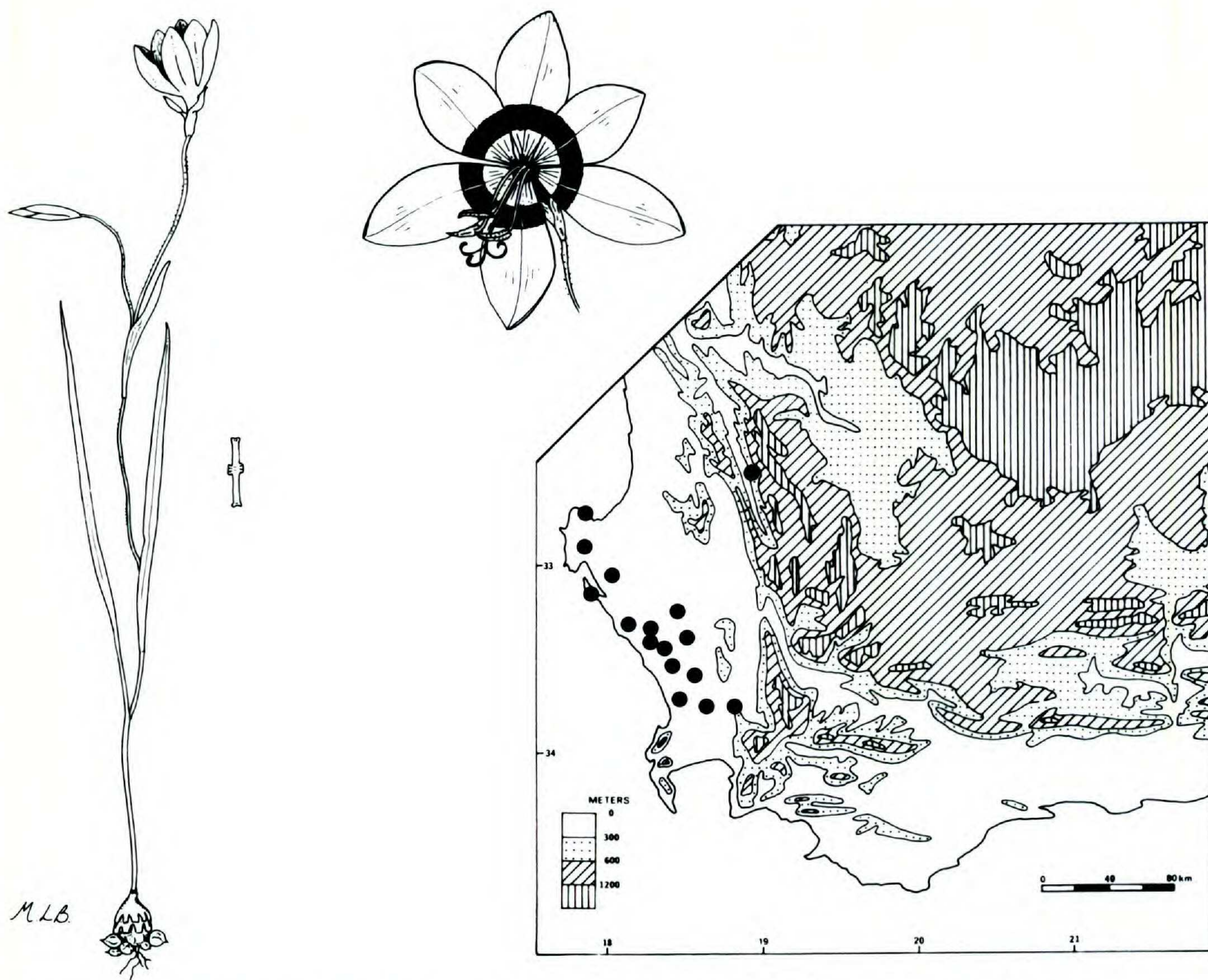


FIGURE 74. Morphology and distribution of *Geissorhiza monanthos*. Habit $\times 0.5$; flower life size; leaf section enlarged (Goldblatt 6286, Mud River road, near Darling).

Geissorhiza monanthos is closely allied to *G. aspera* (*G. secunda* sensu auct.), but also resembles fairly closely the unrelated *G. radians*. *Geissorhiza aspera* has a similar puberulous stem and flat leaf lamina, but smaller and actinomorphic flowers, while *G. radians* has the zygomorphic flower found in *G. monanthos*, but different floral markings, a more cupped flower, smooth stem, and narrow 4-grooved leaves, the upper of which has a strongly ribbed sheath.

Plant size and leaf width vary considerably in *Geissorhiza monanthos*. Plants receiving little rainfall or in dry situations are short, with solitary flowered spikes and filiform leaves while plants growing in seasons of generous rainfall or in favored sites can be to 25 cm high with broad leaves and several flowered spikes. A single population can yield plants covering the whole range of variation for these characters (e.g., Barker 3597, Goldblatt 2705).

Populations in the Darling-Mamre area have

flowers that are blue and red or blue with a yellow center ringed in dark purple (Margin 1168, Barker 724, Loubser 954, Goldblatt 6286, 6272), the type of *Geissorhiza bellendenii* matching the blue- and red-colored form. These plants seem to differ in no other way from pure blue-flowered plants and are treated here as the same species. This bicolored flower is like that found in the related *G. radians* with which *G. monanthos* occasionally grows (Barnard s.n., SAM 68439). The similarity is probably an example of color mimicry, a common phenomenon in the Cape flora, or less likely to hybridization and introgression.

Foster (1941) recognized as a distinct species *Geissorhiza lewisiae*, here reduced to synonymy. He distinguished the species on the basis of the type having slightly unequal filaments, and he grouped it with species such as *G. inaequalis* which also has unequal filaments. I have examined the type, collected by G. J. Lewis at Langebaan, and the only collection of *G. lewisiae*

known to Foster and it is clear that one of the filaments is shorter than the other two, but the difference is no more than 0.5 mm, and this small difference can also be detected in several collections of *G. monanthos*. What seems more remarkable about this collection is that the leaves have a conspicuous, fine pubescence on the margins and major veins. This condition is unusual in *G. monanthos* but can be seen in some collections of the species from the north of its range (Goldblatt 2705, 4084) where it is developed to a lesser degree. There seems little in fact to distinguish *G. lewisiae* and the species is here reduced to synonymy.

In "Flora Capensis," Baker (1896) treated *G. monanthos* as a variety of *G. radians* (as *G. rochensis*), confusing it with *G. eurystigma* L. Bolus, while recognizing as distinct *G. bellendenii*. There is no doubt that Baker was mistaken in considering this a different species. The confusion is probably based on his inadequate knowledge of the type material of *G. monanthos* rather than any fundamental difference between it and the type of *G. bellendenii*.

Specimens examined. SOUTH AFRICA. CAPE: 3217 (Vredenburg) Witteklip, near Vredenburg (DD), *Lewis* 1039 (SAM), *Compton* 15915 (NBG), *Leighton* 597 (BOL), *Goldblatt* 5846 (MO, NBG, US); near Vredenburg, *Lewis* 1041 (SAM).

3218 (Clanwilliam) Steenberg Cove (CC), *Lewis* 1038 (BOL, PRE, SAM), *Leighton* 601 (BOL, K, PRE).

3219 (Wuppertal) 2 mi. N of Citrusdal, Olifants River Valley (CA), *Lewis* 1415 (SAM); 5 mi. N of Citrusdal, *Lewis* 5201 (NBG), *Compton* 20761 (NBG); Citrusdal, *Barker* 3597 (NBG).

3318 (Cape Town) Olifants Kop, E of Langebaan (AA), *Goldblatt* 2705 (BR, MO, PRE, S, US, WAG); Postberg, *Lewis* 5244 (NBG), *Goldblatt* 4084 (MO); Langebaan, *Lewis* s.n. (BOL 20303, K); Snydersfontein, 2 km NW of Platteklop (AC), *Thompson* 3495 (STE); hills around Darling (AD), *H. Bolus* 12844 (BR, MO, PRE); Waylands, Darling, *Barker* 274 (NBG); Darling commonage, *Barker* 8045 (NBG); Darling, *Loubser* 954 (NBG), *Stokoe* s.n. (SAM 56869), *Salter* 1350 (BM); Darling Hill, *Goldblatt* 6272 (MO); granite outcropping, Mud River road, *Goldblatt* 6286 (K, MO, PRE); 2 mi. from Darling on Hopefield road, *Barnard* s.n. (SAM 68439); Groen Kloof, *MacOwan* s.n. in *Herb. Norm. Austr. Afr.* 810 (B, BOL, G, K, S, SAM), *H. Bolus* 4341 (BOL, K); Oudepost, between Malmesbury and Hopefield (BA), *Salter* 3873 (BM, BOL, K); Abbotdale Station (BC), *Martin* 1168 (NBG); 33 mi. N of Cape Town on Malmesbury road (DA), *Gillett* 4146 (MO); 5.3 mi. NW of Klipheuwel, *Acocks* 20644 (PRE); 0.3 mi. NE of Klipheuwel, *Lewis* 4450 (SAM); Phisante Kraal (DC), *Compton* 16015 (NBG); Klapmuts, hard sandy ground (DD), *Lewis* 4449 (MO, PRE, SAM); Joostenberg, sandy flats, *Lewis* 5902 (NBG); Hercules Pillar, *Leighton* 556 (BOL, K).

3418 (Simonstown) Hottentots Holland (BB), *Zeyher* s.n. (SAM 20867).

WITHOUT PRECISE LOCALITY: Malmesbury road, *L. Bolus* s.n. (BOL 31902); Cape, *Siebold* 577 (B), *Masson* s.n. (BM).

71. *Geissorhiza tulbaghensis* F. Bolus, *Ann. Bolus Herb.* 2: 160. 1918; Foster, *Contr. Gray Herb.* 135: 40–41. 1941. TYPE: South Africa. Cape: Tulbagh, *L. Bolus* s.n. [lectotype, BOL 14851, designated by Foster (1941); isoelectotypes, K, PRE]. FIGURE 75.

Plants 6–15 cm high. *Corm* globose, symmetric, truncate at the base, 5–8 mm diam., tunics imbricate, blackish, the outer layers regularly notched below into truncate sections. *Cataphyll* membranous, often broken. *Leaves* 3–4, ensiform to lanceolate, rarely oblong, plane, (1.5–)2–6(–10) mm wide, shorter to slightly longer than stem, often sticky below and with soil adhering, the lower two or three leaves basal, the two lowermost narrow below and often forming a pseudo-petiole, the third sheathing the base of the stem, the uppermost cauline, partly sheathing the stem (sometimes becoming bract-like). *Stem* erect, minutely puberulent, flexed above the leaf sheaths, simple or with 1 or 2 branches from the axils of the cauline or basal sheathing leaf. *Spike* 1, rarely 2-flowered, flexed at the base; *bracts* 10–18 mm long, green below, brown and dry above, the inner shorter than the outer. *Flower* zygomorphic, the stamens unilateral and declinate, held over the horizontal dorsal tepal, the style lying under the stamens, tepals white with maroon-red to brownish markings towards the base; *perianth tube* 4–5 mm long, infundibuliform; *tepals* 18–22 mm long, the outer 10–13 mm wide, the inner 8–11 mm wide. *Filaments* 10–12 mm long, equal, unilateral and declinate; *anthers* 3–4.5 mm long, erect, contiguous, pollen dark red-brown. *Ovary* ca. 4 mm long, style declinate, lying under the stamens, branches ca. 5 mm long, recurved. *Capsule* 6–8 mm long, shorter than the bracts, ovate-oblong. *Chromosome number*, $2n = 26 + 1B$ (*Goldblatt* 5227).

Flowering time. August to mid-September.

Distribution. Heavy, often stony clay soil, in renosterbosveld on the flats at the foot of the mountains between Wellington and Porterville, and in the Tulbagh Valley. Figure 75.

Geissorhiza tulbaghensis is one of the most beautiful species of the genus, having large white

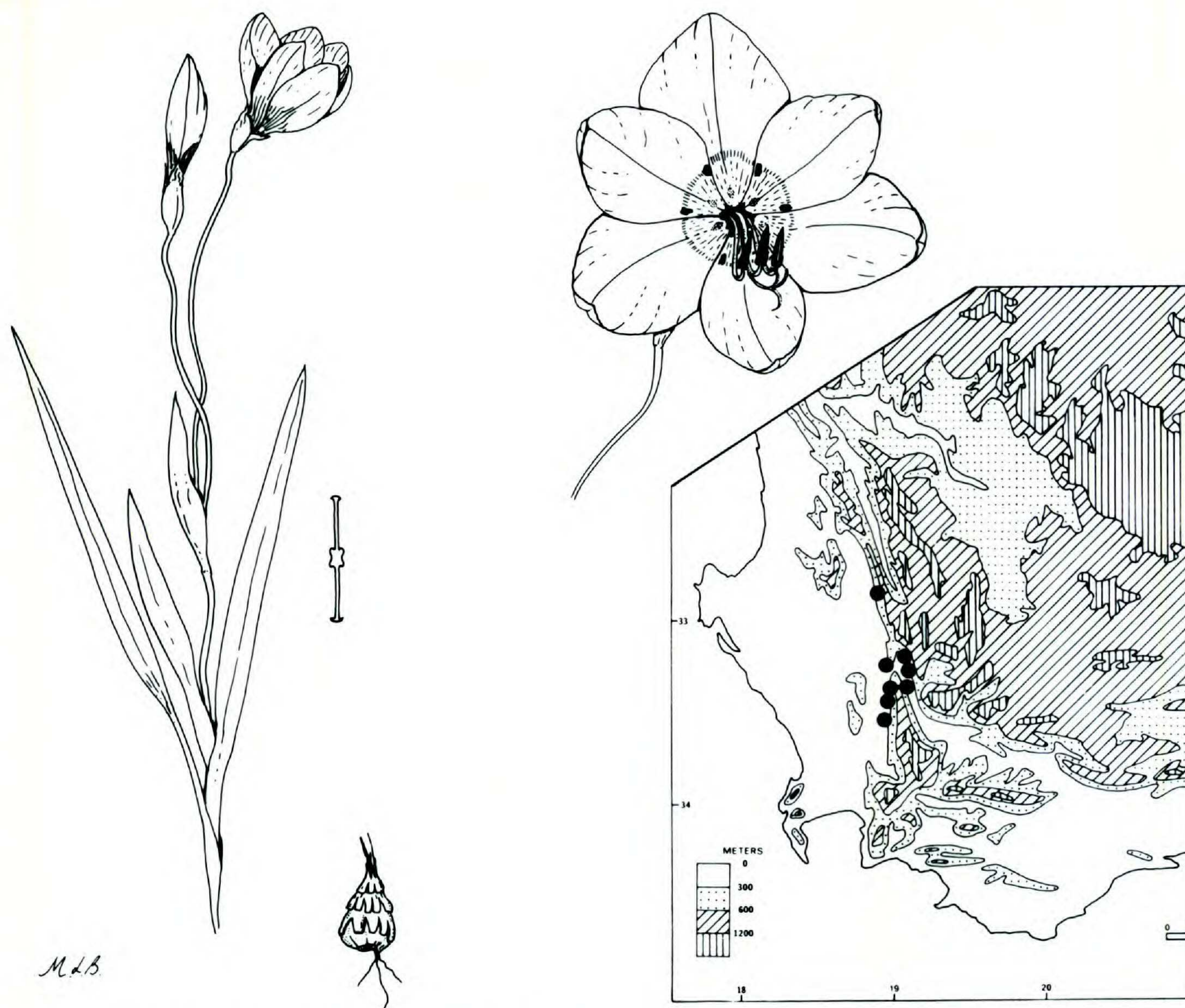


FIGURE 75. Morphology and distribution of *Geissorhiza tulbaghensis*. Habit and corm $\times 0.5$; flower life size; leaf section enlarged (Goldblatt 4755, Tulbagh Cemetery).

flowers marked in the center with maroon-red to brown. It is fairly rare today, and its former range is becoming restricted to fewer sites as the fertile clay flats where it grows are planted to vines or cereals. It appears similar to the well known "wine cup," *G. radians*, and shares with it very similar floral morphology, having large zygomorphic flowers with declinate stamens and style. They are, however, unrelated, *G. tulbaghensis* having plane leaves and a puberulous stem typical of section *Planifolia* while *G. radians* has the linear, 2-grooved leaves and ribbed leaf sheaths characteristic of section *Geissorhiza*.

Geissorhiza tulbaghensis is distinctive not only in its flower coloration, but in its flat leaves which have a peculiar, slender petiole-like base, and puberulous stem. It is worth horticultural attention, and is easy to grow.

Loubser has recorded an interesting case of

sympatry and hybridization involving *Geissorhiza tulbaghensis* on a farm NW of Porterville where this species occurs together with *G. inflexa* and *G. aspera*. Hybrids between both the latter and *G. tulbaghensis* are present and exhibit various degrees of intermediacy between the parents [Loubser 2185, 2187, 2188 (BOL)].

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Nurust farm, 8 mi. NW of Porterville (DD), Loubser 2103 (NBG), 2190 (BOL).

3318 (Cape Town) Wellington (CB), Dawson s.n. (BOL 14011), Grant s.n. (MO).

3319 (Worcester) Tulbagh (AC), F. Bolus & L. Bolus s.n. (BOL 14851, K, PRE), Grant 2423 (MO, PRE), Zeyher s.n. (SAM 20866), Stanford s.n. (BOL); 2 mi. S of Tulbagh, Lewis 5793 (NBG); Tulbagh Cemetery, Goldblatt 4755 (K, MO, PRE, US), 5227 (K, MO, PRE); 3 mi. W of Tulbagh, Marloth 7113 (PRE); Artois, S of Tulbagh, H. Bolus s.n. (BOL 7585); foot of Vogelvllei Mts., near Gouda, Esterhuysen 18798 (BOL);

near Piketberg Road Station (Gouda), *Diels 1164* (B); Tulbagh turnoff, from Hermon, *Mauve 4645A* (PRE, STE).

WITHOUT PRECISE LOCALITY: Cape, *Boucher s.n.* (B "Herb. Lubeck").

SECTION *CILIATA*

12. Section *Ciliata* Goldbl., sect. nov. TYPE: *G. inflexa* (de la Roche) Ker.

Geissorhiza subsection *Pubescentes* Foster, Contr. Gray Herb. 135: 39. 1941. TYPE: *G. erosa* (Salisb.) Foster [= *G. inflexa* (de la Roche) Ker].

Tunicae cormi durae lignosae, foliis plerumque 3, ensiformibus ad linearibus marginibus costisque alatis ciliato-pubescentibus, caule glabro vel puberulo-ciliatis, bracteis infra herbaceis supra siccis ferrugineis, floribus actinomorphae stellatis, tubo brevi, staminibus aequalibus vel inaequalibus.

Corm tunics hard and woody, *leaves* with the margins and midrib moderately to strongly raised and winged, the midrib and sometimes other veins also winged, the edges ciliate-pubescent, ensiform to linear, *bracts* herbaceous below, dry and ferrugineous in the upper half, *flowers* stellate or hypocrateriform, actinomorphic, the tube short or reaching to the apex of the bracts, *stamens* equal or unequal.

Species. 10.

72. *Geissorhiza namaquensis* Barker, Fl. Pl. Africa 18: tab. 688. 1938; Foster, Contr. Gray Herb. 135: 51. 1941. TYPE: South Africa. Cape: Namaqualand, Klipfontein, *Phillips s.n.* (holotype, BOL 22163).

Plants (8–)12–30 cm high. *Corm* globose, 8–10 mm diam., somewhat asymmetric with one side obliquely flattened below and extended downward shortly, tunics dark brown, imbricate, notched below into more or less regular segments, and drawn into points above. *Leaves* usually 3, occasionally 4, about as long as the stem, 2–4 mm wide, evidently flat, but the margins raised and extending for a short distance at right angles to the blade and with ciliate edges, midrib also raised and winged and ciliate on the edges, sometimes a second pair of veins also ciliate, the lower two leaves basal, the third leaf inserted above the ground and sheathing below, similar but shorter than the basal leaves, fourth leaf, if present, shortest and becoming bract-like. *Stem* more or less erect, flexed at the base of the spike, minutely and sparsely puberulous below, sometimes with 1 branch. *Spike* inclined, flexed at the

base, flexuose, 2–8-flowered; *bracts* green, herbaceous, dry and membranous, pale becoming brownish only near the apex, (9–)12–16(–20) mm long, the outer completely enclosing the smaller inner bract. *Flower* hypocrateriform, blue-purple; *perianth tube* (6–)8–11 mm long, reaching the apex of, or just exceeding the bracts, cylindrical, widening near the throat; *tepals* 14–18 mm long, elliptic, to 4 mm wide. *Filaments* equal, 5–6 mm long; *anthers* (2–)4–6 mm long, yellow. *Ovary* 2–4 mm long, *style* dividing near the middle or towards the apex of the anthers, becoming unilateral, branches 1–3 mm long, recurved. *Capsule* globose, to 8 mm long. *Chromosome number*, unknown.

Flowering time. September to October.

Distribution. Northern Namaqualand, in Renosterbos type vegetation on shale and quartzite slopes. Figure 76.

Geissorhiza namaquensis and its more specialized, long-tubed relative, *G. kamiesmontana* are a closely related pair of species and the only members of the genus endemic in Namaqualand. Although at first glance *Geissorhiza namaquensis* resembles the Western Cape *G. aspera* (syn. *G. secunda* sensu auct.), its winged and ciliate leaf margins and midrib and its well-developed perianth tube suggest a very fundamental difference between them. *Geissorhiza namaquensis* and *C. kamiesmontana* are most likely related to species of section *Ciliata* where similar leaves are found. However, they seem taxonomically isolated in the section and probably represent a fairly old line, perhaps close to the ancestral type of the section, while the remaining species have evolved more rapidly and become specialized in their very short perianth tubes and dry bracts that are brown by the time the flowers open rather than drying after the flowers fade as in *G. namaquensis*.

Geissorhiza namaquensis occurs locally on the Kamiesberg on granitic soil, but elsewhere in Namaqualand is restricted to the few outcrops of shales and quartzites of the ancient Nama system, which once covered Namaqualand, but is now largely eroded away. All collections away from the Kamiesberg have been made in the north–south trending belt of Nama Shale that occurs west of Springbok and extends northward, somewhat beyond Steinkopf. This soil, very different from the granitic sands typical of Namaqualand, supports an interesting flora which shows many links with the Cape Flora to the

south (Goldblatt, 1979a: 388). It supports several Iridaceae either occurring elsewhere only in the Cape Region, or endemic, but having their closest affinities with Cape taxa.

Specimens examined. SOUTH AFRICA. CAPE: 2917 (Springbok) Klipfontein (B-), *Phillips s.n.* (Nat. Bot. Gard. 1471/30 in BOL, K); Steinkopf (BA), *Marloth 6782* (B, BOL, PRE, STE), *Herre s.n.* (STE 11844); stony hillside, Steinkopf, *Lewis 5495* (NBG); Kosies NW of Steinkopf, *van Berkel 399* (MO); Spektakel Pass W of Springbok (DA), *Goldblatt 2803* (K, MO, NBG, PRE, WAG); 15.25 mi. W by S of Springbok, renosterveld on shale and quartzite hills, *Acocks 19580* (K, M, NBG, PRE).

3018 (Kamiesberg) Leliefontein, foot of Kamiesberg Mt. (CC), *Le Roux & Ramsey 672* (PRE).

73. *Geissorhiza kamiesmontana* Goldbl., sp. nov.

TYPE: South Africa. Cape: Kamiesberg, E slopes of Rooiberg near Welkom, *Goldblatt 5770* (holotype, MO; isotypes, K, NBG, PRE, WAG).

Planta (10–)15–30 cm alta, foliis 3–4, inferioribus duobus basalibus, marginibus elevatis, pubescentibus, costis centralibus elevatis alatis pubescentibus, caule pubescente, spicis florum 1–4, floribus hypocrateriformibus, atrocaeruleis, tubo 18–25 mm longo, tepalis 16–20 mm longis, stylo diviso prope basem antherarum.

Plants (10–)15–30 cm high. *Corm* globose, ca. 10 mm diam., somewhat asymmetric with one side flattened obliquely below and sometimes extending downward, tunics dark brown, imbricate, notched below into nearly regular segments and drawn into points above. *Cataphyll* 1 or 2, membranous, brownish. *Leaves* 3 or 4, ensiform, 2–3 mm wide, reaching to about the base of the spike, the margins lightly raised and extending at right angles to the blade, the midrib also raised and winged, the edges of the margins, midrib and other veins pubescent, the lower two leaves basal, the upper of these sheathing the stem shortly, the upper one or two cauline, the fourth leaf (when present) smallest and becoming bract-like. *Stem* erect, puberulent-pubescent throughout, including the spike axis, 1–2-branched. *Spike* 1–4-flowered; *bracts* green, becoming dry from the apex, eventually turning brown above, 12–18 (–21) mm long, the inner completely enclosed by the much longer outer bracts. *Flower* hypocrateriform, deep blue, with pale throat and tube; *perianth tube* 18–25 mm long, cylindric below, widening gradually above the bracts; *tepals* 16–20 mm long, elliptic, ca. 3 mm wide. *Filaments* 8–10 mm long, equal; *anthers* 3–4 mm long, yel-

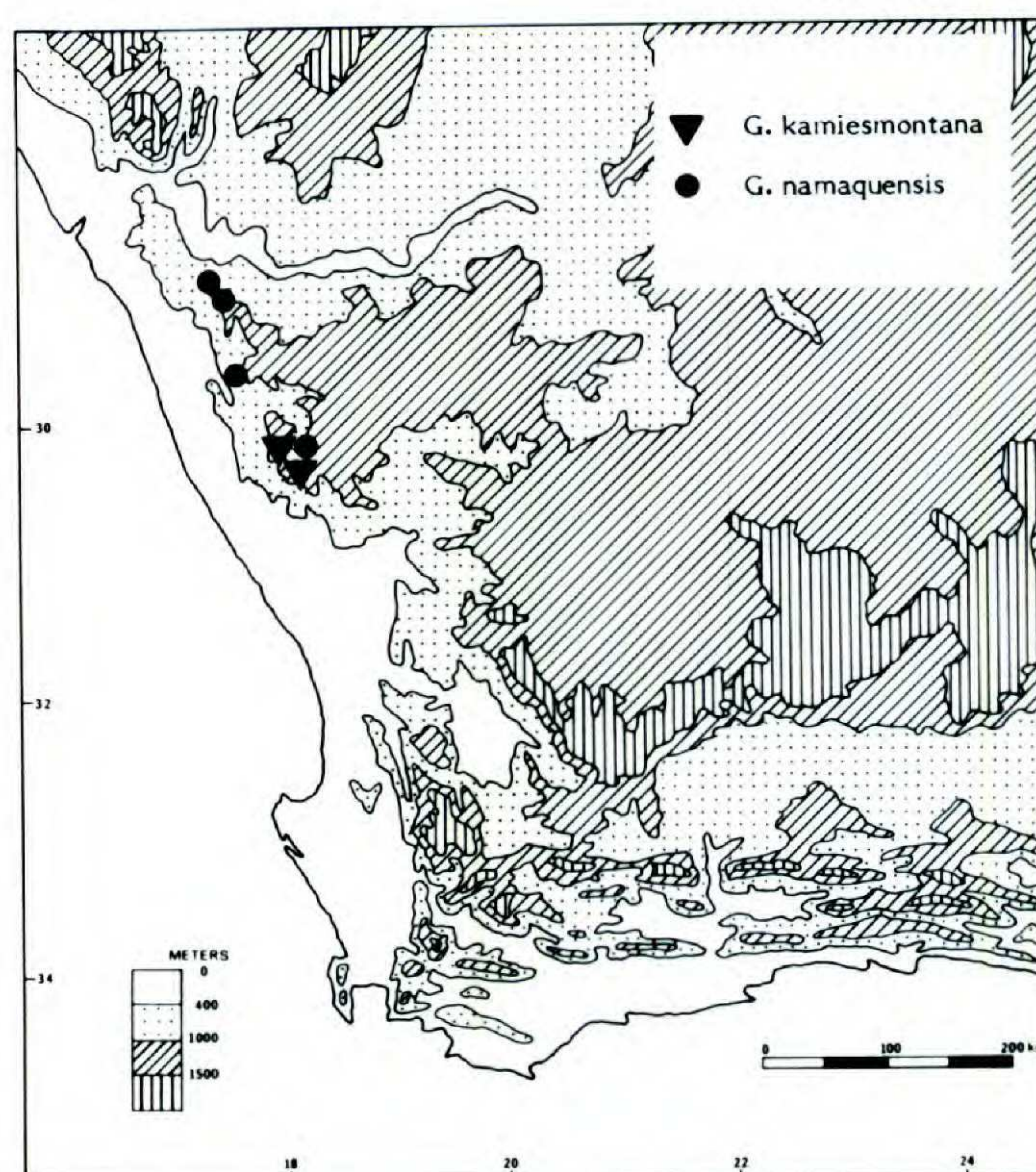


FIGURE 76. Distribution of *Geissorhiza namaquensis* and *G. kamiesmontana*.

low. *Ovary* ca. 3 mm long, *style* dividing near the base of the anthers, branches ca. 2.5 mm long, recurved, and reaching the middle of the anthers only. *Capsule* oblong to globose, 6–9 mm long. *Chromosome number*, $2n = 26$ (*Goldblatt 5770*).

Flowering time. September.

Distribution. Middle altitudes in the Kamiesberg, in central Namaqualand. Figure 76.

Geissorhiza kamiesmontana is known from only two gatherings from middle altitudes in the Kamiesberg Mountains of central Namaqualand, where it is apparently endemic and restricted to a few sheltered sites. I made the type gathering on the eastern slopes of the Rooiberg where shade from rocks and tall shrubs gave shelter to the plants which grow in shallow soil near seasonal pools and streamlets.

The species is clearly related to the other endemic Namaqualand species of *Geissorhiza*, *G. namaquensis* which is similar in general appearance. The two have identical corms, puberulent stems and similar leaves with raised and winged margins and pubescence on the margin and midrib edges. *Geissorhiza kamiesmontana* is easily distinguished from *G. namaquensis* by its well-developed perianth tube, 18–25 mm long which much exceeds the long bracts; its deep blue flower with a relatively short style, the branches of which do not exceed the anthers; and the heavy, almost

velvety, white pubescence on the leaves, stem, and inflorescence. The collection made by Leipoldt "in a kloof near Kamieskroon" has particularly long bracts (to 21 mm) compared with the type material, in which the bracts are to 18 mm long. The flowers of *Geissorhiza namaquana* are pale blue and have a much shorter tube, 6–11 mm long, which is usually about as long as the bracts, while the stem and leaf pubescence is less pronounced.

Specimens examined. SOUTH AFRICA. CAPE: 3017 (Hondeklipbaai) Kloof near Kamieskroon (BB), Leipoldt 3815 (BOL).

3018 (Kamiesberg) E slopes of Rooiberg near Welkom (AC), Goldblatt 5770 (K, MO, NBG, PRE, WAG), 6703 (MO).

74. *Geissorhiza divaricata* Goldbl., sp. nov. TYPE: South Africa. Cape: W of Nieuwoudtville, among rocks in fynbos, Goldblatt 5838 (holotype, MO; isotypes, K, NBG). FIGURE 77.

Planta (15–)20–45 cm alta, foliis 3, duobus inferioribus basalibus erectis linearibus, marginibus extensis, floribus (2–)3–5, stellatis albis vel malvinescentibus, tubo 1–2 mm longo, tepalis ca. 10 mm longis, filamentis aequalibus, ca. 3 mm longis, antheris 3–4 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants (15–)20–45 cm high. *Corm* globose, tapering above, and obliquely flattened below, 10–12 mm diam., tunics blackish, imbricate notched below into segments. *Cataphyll* firm, brownish, persistent, and accumulating with leaf bases in a fibrous neck around the stem base. *Leaves* 3, linear to ensiform, 2–3 mm wide, the margins thickened and extending at right angles to the lamina, midrib extended and winged, and one or two pairs of veins enlarged, margin edges and veins ciliate-pubescent, the lower two leaves basal, half to about as long as stem, the uppermost leaf inserted in the middle part of the stem, sheathing the upper half of the stem for half to two-thirds its length. *Stem* erect, smooth, usually bearing in addition to the sheathing cauline leaf, one or more short, dry, membranous bracts, and branched from these nodes and also sometimes from the cauline leaf axil, sharply flexed above the nodes and at the base of the spike. *Spike* flexed at the base, inclined, (2–)3–5-flowered, flexuose; *bracts* dry, membranous and brown at flowering, flexed outwards in the upper half, 5.5–7 mm long, the inner shorter than the outer. *Flowers* stellate, white to pale mauve, reddish purple on the reverse of the outer tepals; *perianth*

tube 1–2 mm long, much shorter than the bracts; *tepals* ca. 10 mm long, ovate-elliptic, ca. 4 mm wide. *Filaments* equal, ca. 3 mm long; *anthers* 3–4 mm long. *Ovary* 1–2 mm long, *style* dividing near the upper third of the anthers, branches recurved. *Capsule* globose, 4–5 mm long. *Chromosome number*, unknown.

Flowering time. September.

Distribution. Nieuwoudtville Escarpment and Gifberg, in rocky situations in fynbos. Figure 77.

Geissorhiza divaricata is apparently very closely allied to *G. subrigida*, a poorly known species of the Nieuwoudtville area. The two are distinctive in having a sheath of fibers around the stem base, smooth stems, ciliate to pubescent and ribbed leaves, divaricate branching, and brown, membranous stem bracts. These shared similarities have tended to obscure their differences and *G. divaricata* has until now been identified with *G. subrigida*. The differences between the two species, however, seem significant. *Geissorhiza divaricata* has small white to pale mauve flowers with a perianth tube 1–2 mm long and tepals ca. 10 mm, while *G. subrigida* has large blue to violet flowers with perianth tube 3–4 mm long and tepals 12–17 mm long. Also *G. divaricata* tends to be taller and more branched and it has smaller corms than the shorter and few branched *G. subrigida*. Both grow along the Nieuwoudtville Escarpment in the rocky sandstone soils of the area, but have not been recorded growing together. The Nieuwoudtville area is a well known center of endemism for geophytic plants, Iridaceae in particular, so the occurrence of two distinct, but closely allied species here is not particularly surprising.

Included in *Geissorhiza divaricata* are two collections from the Gifberg, a short distance to the southwest, Barker 9571 and Bayliss 6187, specimens of which have either simple or single branched stems and lack the distinctive dry stem bracts found in the Nieuwoudtville populations. The specimens approach *Geissorhiza erubescens* in outward appearance, but do not have the pubescent stems of that species.

Specimens examined. SOUTH AFRICA. CAPE: 3118 (Vanhynsdorp) top of Gifberg Pass (DD), Barker 9571 (NBG), Bayliss 6187 (MO).

3119 (Calvinia) near Nieuwoudtville (AC), Leipoldt 821 (BOL, SAM), L. Bolus s.n. (BOL 21060); fynbos W of Nieuwoudtville in rock crevices, Goldblatt 5838 (K, MO, NBG); Uitkomst farm, SW of Nieuwoudtville, Barker 10745 (K, NBG).



FIGURE 77. Morphology and distribution of *Geissorhiza divaricata* (left) and *G. subrigida* (right). Habits $\times 0.5$; flowers life size; leaf sections much enlarged (*G. divaricata*, Goldblatt 5838, Nieuwoudtville Escarpment; *G. subrigida*, Goldblatt 7220, W of Nieuwoudtville).

- 75. *Geissorhiza subrigida* L. Bolus, S. African Gard. 22: 275. 1932. TYPE:** South Africa. Cape: near Nieuwoudtville, cult. in hort. L. Bolus, Cape Town, *Buhr s.n.* [holotype, BOL 19995 (publ. as 19943); isotypes, K, PRE]. FIGURE 77.

Plants 12–20(–30) cm high. *Corm* globose, tapering above, and obliquely flattened below, 1–1.5 cm diam., tunics blackish, imbricate, notched below into segments. *Cataphyll* firm, brownish, persistent and accumulating with leaf bases in a fibrous neck around the stem base. *Leaves* 3, half to about as long as the stem, 3–6 mm wide, the margins thickened and extending at right angles to the blade, the midrib also raised and winged and at least two other pairs of veins enlarged, ciliate to pubescent on the veins and margin edges, the lower two leaves basal, the uppermost inserted in the middle part of the stem and sheathing for at least two-thirds its length, several ribbed. *Stem* erect, smooth, bearing in addition to the sheathing cauline leaf, a short, dry, membranous bract and usually branched from this node and also sometimes from the axil of the cauline leaf, flexed above the nodes and at the base of the spike. *Spike* flexed at base, (2–)3–5-flowered, flexuose; *bracts* 6–10 mm long, dry, membranous and brown at flowering time, flexed outward in the upper half, the inner shorter than the outer. *Flowers* stellate, violet blue, pale in the tube; *perianth tube* 2–3 mm long, shorter than the bracts; *tepals* 12–17 mm long, ovate-elliptic, to 7 mm wide. *Filaments* equal, ca. 4 mm long; *anthers* 4–5 mm long. *Ovary* 1.3–2 mm long, *style* dividing at or near the apex of the anthers, becoming declinate, branches recurved. *Capsule* globose, ca. 4 mm long. *Chromosome number*, unknown.

Flowering time. August to mid-September.

Distribution. Sandy soils around Nieuwoudtville. Figure 77.

Geissorhiza subrigida is an unusual species with comparatively large blue to violet flowers, strongly ciliate-pubescent leaves and a divaricate branching pattern. It is very local in distribution, being recorded only from the immediate vicinity of the town of Nieuwoudtville in the northwestern Cape. Closely allied is *G. divaricata* which is similar in vegetative morphology, but has smaller, white to pale mauve flowers. The similarities and differences between these two species are

discussed more fully following the description of *G. divaricata*.

The leaves of *Geissorhiza subrigida* and *G. divaricata*, with their raised and flattened margins extending at right angles to the lamina and the raised and winged midrib, both ciliate on their edges are similar to those of *G. inflexa* and *G. heterostyla* in particular, although the latter two have a lighter pubescence. They seem well placed in section *Ciliata*, in which their branched habit, the presence of stem bracts, and their equal stamens suggest that they are fairly unspecialized.

Specimens examined. SOUTH AFRICA. CAPE: 3119 (Calvinia) Nieuwoudtville (AC), *Buhr s.n.* (cult.) (BOL 19995, K, NBG 60617, 60618, PRE, STE 17319); Glenridge farm, Nieuwoudtville, *Lewis 5886* (NBG); shallow sandy soil in recently burned veld W of Nieuwoudtville, S of the old road to the pass, *Goldblatt 7220* (K, MO, PRE).

- 76. *Geissorhiza heterostyla* L. Bolus, S. African Gard. 20: 345–346. 1930; Foster, Contr. Gray Herb. 135: 44–45. 1941. TYPE:** South Africa. Cape: near Whitehill, *L. Bolus s.n.* (lectotype, BOL 19148, here designated; isolecotypes, BM, BOL, K). FIGURE 78.

Gessorhiza rogersii N. E. Br., Kew Bull. 452. 1931. TYPE: South Africa. Cape: Worcester, between Osplaats and Tunnel Sidings, 600–900 m, *Rogers 16725* (lectotype, K, here designated; isolecotypes, J, K).

Hesperantha rosea Klatt, Abh. Naturf. Ges. Halle 15: 395 (Erg. 61). 1882. TYPE: South Africa. Cape: Knysna, *Newdegate s.n.* (holotype, B “Herb. Lubeck”).

Geissorhiza rosea (Klatt) Foster, Contr. Gray Herb. 135: 48. 1941, hom. illeg. non Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 20. 1827 [= *G. inflexa* (de la Roche) Ker].

Hesperantha ciliata E. Mey. ex Klatt, Abh. Naturf. Ges. Halle 12: 394 (Erg. 60). 1882. TYPE: South Africa. Cape: Hexrivierskloof, *Drège s.n.* (holotype, B “Herb. Lubeck”), nom. superfl. pro *Geissorhiza rosea* Ecklon.

Plants 12–45 cm high. *Corm* symmetric, 4–12(–15) mm diam., globose, tunics blackish, woody, outer accumulating above, and notched regularly into segments below. *Cataphyll* membranous, often dark above. *Leaves* 3, linear to ensiform, 2–5 mm wide, half to about as long as the stem, the margins raised and extended at right angles to angles to the blade and ciliate on the edges, the midrib also raised and ciliate, the lower two leaves basal, the uppermost basal or cauline, sheathing for most of its length, several

ribbed on the sheath. *Stem* erect, puberulous to ciliate or smooth, simple or more often branched, sheathed for up to three-fourths its length, bearing a membranous, often dry, bract leaf in the upper part, and usually branching from this axil, or also from the axil of the sheathing leaf. *Spike* (1–)2–7-flowered, flexed at base and flexuose; *bracts* 7–10(–15) mm long, initially pale green with hyaline margins, but drying from apex and becoming transparent, or flushed red or brown, the inner shorter than the outer. *Flower* stellate, either white, flushed pink to purple on reverse of the tepals, or pale blue to mauve, white to yellow or occasionally dark purple in the throat; *perianth tube* 1–2 mm long; *tepals* 10–18(–22) mm long, obovate, 6–9 mm wide. *Filaments* unequal, the two longer 4–6 mm long, the shorter 3–4 mm long; *anthers* (2.5–)4–6 mm long, yellow or blue-black. *Ovary* 1.5–3(–4) mm long, *style* short to long, either dividing near the base of filaments, with long branches, or reaching to the base or to the apex of the anthers and branches short or long, ultimately recurved. *Capsule* globose, 5–8 mm long. *Chromosome number*, $2n = 26$ (Hall 193—as Hall s.n., Voelvlei, Sutherland; Goldblatt 135—as *G. leipoldtii*, 5815, 6265), $26 + 2B$ (Goldblatt 5211).

Flowering time. August to early October.

Distribution. Widespread from the Kubiskouw Mountains in south Namaqualand through the Roggeveld and Witteberg to the southern Cape as far east as Port Elizabeth; on various soils but usually on sand in the Cape Floristic Region. Figure 78.

Geissorhiza heterostyla was described by H. M. L. Bolus in 1930 based on a collection of plants from Whitehill in the western Karoo. The outstanding characteristic of the type collection is the variable length of the style. Plants have either long styles, dividing beyond the apex of the anthers; medium styles dividing at anther level; or short styles, dividing below anther level. Other distinguishing features of the collection are a puberulous stem; a submembranous stem bract; leaves with winged, ciliate margins; and unequal stamens, the latter feature not noticed by Bolus, but quite evident in the ample type material.

Other collections matching the type have since been made in the same area, e.g., Lewis 4790—Eendracht; Barker 7492—Tweedside; Compton 3772—Cobita—all heterostylous, as well as a few like Compton 15172 and Leighton 201, both from

the nearby Witteberg that cannot be distinguished from *G. heterostyla* except that the styles are invariably long. Phillips 1549, from Seven Weeks Poort, consists of heterostylous plants with either smooth or sparsely papillose stems. The nonheterostylous collections from the Witteberg match closely plants from the Ceres, Koo, and Hex River Valleys, e.g., Esterhuysen 20344—Eselsfontein; Barker 1473—Theronsberg; Loubser 2061—Koo Valley; Oliver 5015—Prince Alfreds Hamlet; and Rogers 16725—Osplaats—Tunnel Sidings, the latter the type collection of *G. rogersii* (Brown, 1931).

Heterostylous gatherings of *Geissorhiza heterostyla* have also been made in the Roggeveld, in the Calvinia district, and in the Kubiskouw Mountains in southern Namaqualand. Again, some collections that match the heterostylous material appear to consist solely of long-styled plants (Goldblatt 549—Verlaten Kloof; Goldblatt 5815—near Middelpoos; Goldblatt 5824—Hantamsberg). It is clear that the homostylous populations are the same taxon, and *G. heterostyla* must now be regarded as consisting of either heterostylous or homostylous populations. *Geissorhiza rogersii* accordingly falls into synonymy of *G. heterostyla*.

The Witteberg, Ceres, and Hex River Valley populations of *G. heterostyla* are generally smaller, and less robust than plants from the Roggeveld and the Calvinia district (though not invariably), and in turn are easily confused with plants named *G. rosea* (Klatt) Foster (actually a homonym for *G. rosea* Ecklon), which can be separated by their having leaves with less strongly elevated margins and usually smooth stems. Populations of plants matching *G. rosea* sensu Foster extend from Worcester south and east along the Langeberg and southern coast to Port Elizabeth, usually occurring on sandy soils. Plants are not always slender or invariably with smooth stems. Some notable exceptions are Goldblatt 2544—Op de Tradouw, robust and with puberulous stems; Goldblatt 4929—Humansdorp, also very robust; Beacom s.n.—near Joubertina, slender but with a puberulous stem; and Esterhuysen 24654—foot of Leeuriviersberg, slender to fairly robust plants with a puberulous stem.

Plants that would be considered to be *Geissorhiza rosea* grade into the homostylous form of *G. heterostyla* to the extent that it seems unreasonable to maintain them as a distinct species. Nor is there any good character except perhaps

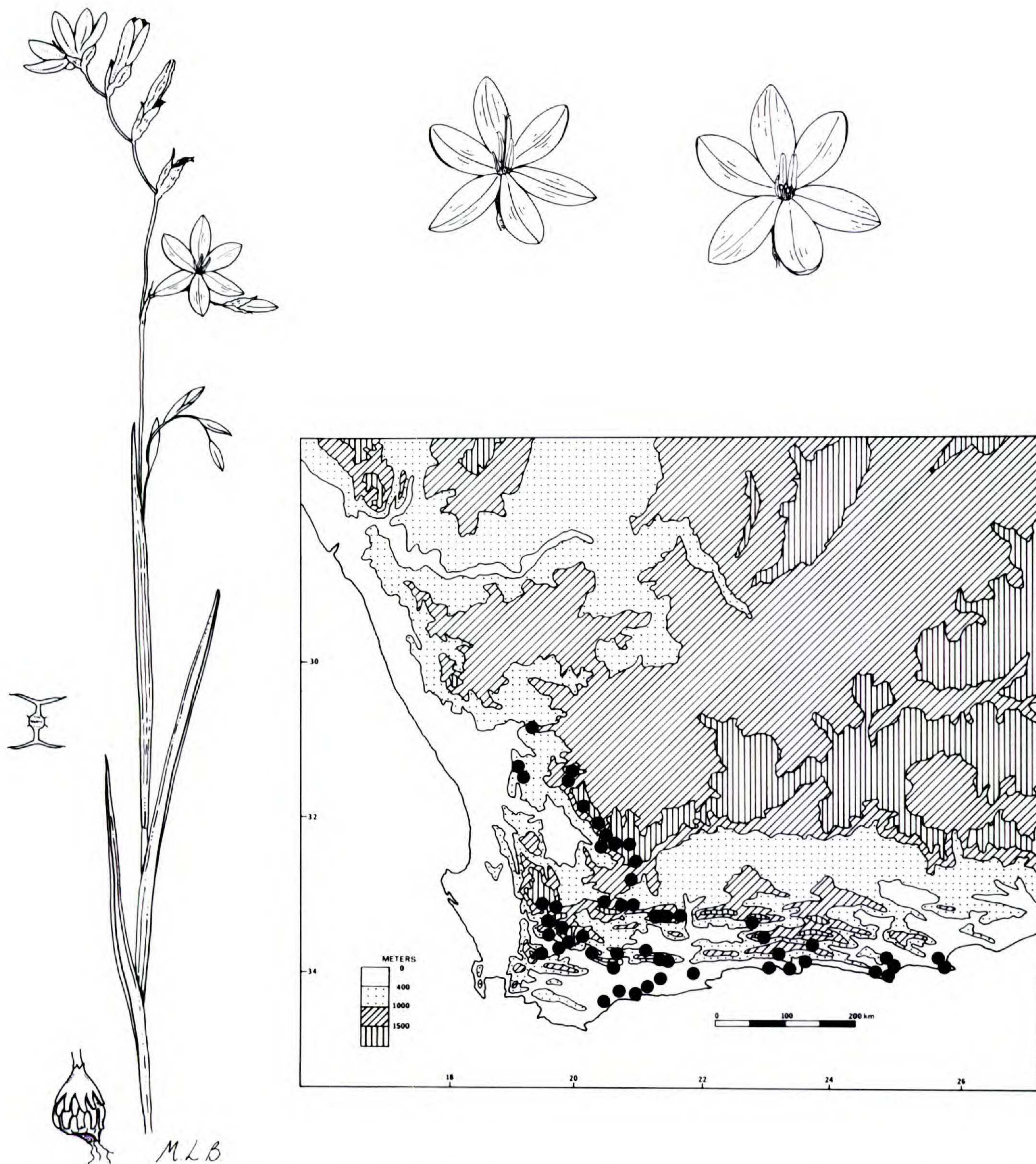


FIGURE 78. Morphology and distribution of *Geissorhiza heterostyla* showing both long and short styled flowers. Habit and corm $\times 0.5$; flowers life size; leaf section much enlarged (*Goldblatt 6265*, Nieuwoudtville).

the degree of leaf margin elevation that can be consistently used to separate them. Thus *G. rosea* and its synonyms *Hesperantha ciliata* E. Mey. ex Klatt nom. superfl. and *G. ciliaris* Salisb. are here regarded as conspecific with *G. heterostyla*. While there may be some merit in establishing a subspecific taxonomy for *G. heterostyla* it seems quite arbitrary to which subspecific taxa some of the intermediate forms should be assigned. I have decided therefore, not to formally recognize sub-

specific taxa. Those who need to refer to one of the forms of *G. heterostyla* should use an informal trinomial terminology as suggested by Burtt (1970). Thus slender and smooth (rarely puberulous) stemmed and long-styled plants with leaf margins raised relatively little compared to leaf width can be referred to as *G. heterostyla* (*rosea*). Populations of heterostylous plants, typically with puberulous stems (rarely smooth) and leaves with margins raised well above the leaf surface can

similarly be designated *G. heterostyla* (*heterostyla*), while homostylous populations can be designated *G. heterostyla* (*rogersii*).

Two more forms of *Geissorhiza heterostyla* need to be mentioned. The first consists of distinctive plants with medium to large white flowers (*Thomas s.n.*—Eilandia Road; *Olivier 283*—Karoo Garden) which initially appears different from other populations. Little more than a color difference however seems to be involved, as similarly large-flowered plants occur elsewhere. The second population, from Stettynskloof, south of Worcester (*Barker 9455*), incidentally the most westerly station, seems fairly typical at first having very unequal stamens and pale flowers. All but one of the several specimens on the sheet lack the membranous stem bract, and except for the unequal stamens these plants are very like the related *G. inflexa* which occurs in this area and to the south. It seems that this population, on the edge of the range of *G. heterostyla*, is intermediate in some respects with *G. inflexa*, possibly as a result of introgressive hybridization.

Some collections from the Sutherland district, notably *Hanekom 1562*—Houthoek and *Acocks 15963*—Klipbanksrivier, are remarkably robust and the large flowers are purple with darker pigmentation in the center. These specimens appear to represent a distinct local race or form of *G. heterostyla*.

Specimens examined. SOUTH AFRICA. CAPE: 3019 (Loeriesfontein) Kubiskouw, near summit (CD), *Marloth 12870* (PRE).

3119 (Calvinia) near Nieuwoudtville on the Loeriesfontein road (AC), *Lewis 5850* (NBG); 1 mi. N of Nieuwoudtville, *Barker 9563* (NBG, S, STE), *Goldblatt 135* (J); Grasberg road NW of Nieuwoudtville, *Goldblatt 6265* (MO); W end of the Hantamsberg Plateau (BC), *Goldblatt 5824* (K, MO, NBG); upper slopes below cliffs at the W end of the Hantamsberg, *Goldblatt 5805* (K, MO, NBG, PRE); wet red clay, top of Hantamsberg (BD), *Goldblatt 426* (BOL); Driefontein voor Hantam (DA), *Marloth 12811* (PRE).

3120 (Williston) Blomfontein farm, E of Middelpoos (CC), *Barker 10774* (K, NBG); 66 km S of Calvinia, on road to Blomfontein, *Goldblatt 5815* (MO, PRE);

3220 (Sutherland) Geelhoek (Vyffontein), Sutherland (AB), *Acocks 17175* (PRE); Quaggasfontein, NW of Sutherland, *Goldblatt 6355* (MO); Houdenberg, NW of Sutherland (AD), *Thompson 1796* (K, STE); Voelfontein, S of farm house, *Goldblatt 6322* (MO); Voelfontein, *Hall 193* (NBG, S); Jakhals Valley, Sutherland (BC), *Marloth 9654* (PRE); top of Verlaten Kloof, *Goldblatt 549* (BOL); Houthoek, Sutherland (CA), *Hanekom 1562* (MO, NBG, PRE); Klipbanksrivier, foot of the Roggeveld Mts. (CB), *Acocks 16963* (K, PRE); 13.5 mi. SSW of the foot of Komsberg Pass (DC),

Acocks 18447 (BOL, K, PRE); 20 mi. SSW of the foot of Komsberg Pass, *Leistner 269* (PRE).

3319 (Worcester) Gydo Pass, lower slopes (AD), *Hafstrom & Acocks 284* (K, PRE); flats NW of Prince Alfreds Hamlet, *Oliver 5015* (PRE); Eselsfontein, Ceres, *Esterhuysen 20344* (BOL); Ceres, *Lindeberg s.n.* (S), *Rogers 28701* (Z); Hex River Valley (BC-DA), *Tyson 723* (SAM); Theronberg, Ceres (BC), *Barker 1473* (NBG); Prospect Peak, Hex River Mts., SE slopes (BC), *Esterhuysen 15941* (BOL); Onse Rug farm (CB), *Barker 9443* (NBG); lower slopes of Fonteintjiesberg, Onse Rug farm, *Goldblatt 4089* (E, MO, PRE, S, US, WAG); Worcester, Nature Reserve, *Olivier 283* (K); Stettynskloof (CD), *Barker 9455* (NBG); Eilandia road, 5–6 mi. from Worcester-Robertson road (DA), *Thomas s.n.* (NBG 93061, PRE 58032); NW entrance to Koo valley (DB), *Loubser 2061* (NBG); Langeberg, above Bergen-Dal, cliff face, 2,200 ft., *Esterhuysen 35684* (BOL, MO); Bergen-Dal, above Klaasvoogds, slopes near the base of the Langeberg, *Esterhuysen 35797* (MO, PRE, WAG).

3320 (Montagu) Voetpadsberg, Tweedside (AB), *Barker 7492* (NBG); Tweedside, *Lewis s.n.* (Nat. Bot. Gard. 2694/32 in BOL, K, SAM); Witteberg, Laingsburg (BA), *Leighton 201* (BOL); Witteberg at Bantams, 5,000 ft., *Compton 12244* (NBG); Witteberg, Whitehill, *Compton 13997* (NBG), *15172* (NBG), *16277* (NBG); Whitehill, *L. Bolus s.n.* (BM, BOL 19148); Donkerkloof, Montagu (CC), *Lewis 4789* (SAM); slopes at foot of the Langeberg near Leeuviersberg (CD), *Esterhuysen 24564* (BOL, PRE); Op-de-Tradouw, W of Barrydale (CD), *Goldblatt 2844* (MO, PRE).

3321 (Ladismith) Elandsberg (Torenberg), Klein Swartberg, Ladismith, 3,000 ft. (AD), *Wurts 1174* (NBG); Seven Weeks Poort, *Phillips 1549* (SAM); Ladismith, *Loubser 2086* (NBG); Gamka Nature Reserve, Calitzdorp (BC), *Vlok 316* (MO, SAAS); The Oaks, Gysmanshoek Pass, Riversdale (CC), *van Wyk 722* (MO, STE); damp slope, Garcias Pass, *Lewis 5646* (NBG).

3322 (Oudtshoorn) Swartberg, hills above the Cango Caves (AD), *Vlok 292* (MO, NBG, SAAS); Kammassie Mts., 2,800 ft. (DB), *Viviers & Vlok s.n.* (MO, SAAS).

3323 (Willowmore) Bo Koega, near Joubertina, *Bayliss 5954* (MO); hills N of Kruisfontein (CC), *Fourcade 4430* (STE); Joubertina, beside National Road (DD), *Beacom s.n.* (NBG 87524, 92829).

3324 (Steytlerville) 4 mi. N of Humansdorp, Hankey road (DD), *Fourcade 6160* (STE).

3420 (Bredasdorp) Swellendam (AB), *Fry sub Galpin s.n.* (B); Limestone hills, De Hoop (AD), *Lewis 6019* (M, NBG); Potteberg, ledges on S slopes (BC), *Esterhuysen 23210* (BOL, K); Hamerkop, S side of Potteberg, *Acocks 22745* (PRE); valley behind Oyster Beds Hotel, Fort Beaufort (BD), *Marsh 824* (K, STE); Cape Infanta, *Blum 18* (E); Duiwenhokrivier Kloof, between Port Beaufort and Riversdale, *Lewis 6013* (MO, NBG, STE).

3421 (Riversdale) Still Bay, ridge below the reservoir (AD), *Bohnen 4251* (STE); Roodehoogte, near Herbertsdale (BB), *Muir 1271* (BOL); Langeberg foothills N of Herbertsdale, *Goldblatt 4156* (MO, PRE, S).

3423 (Knysna) Victoria Bay, George (AA), *Barker 8181* (NBG, STE); slopes above Victoria Bay, *Lewis 3631* (SAM); near George, *Burchell 6088* (K); Noetzie

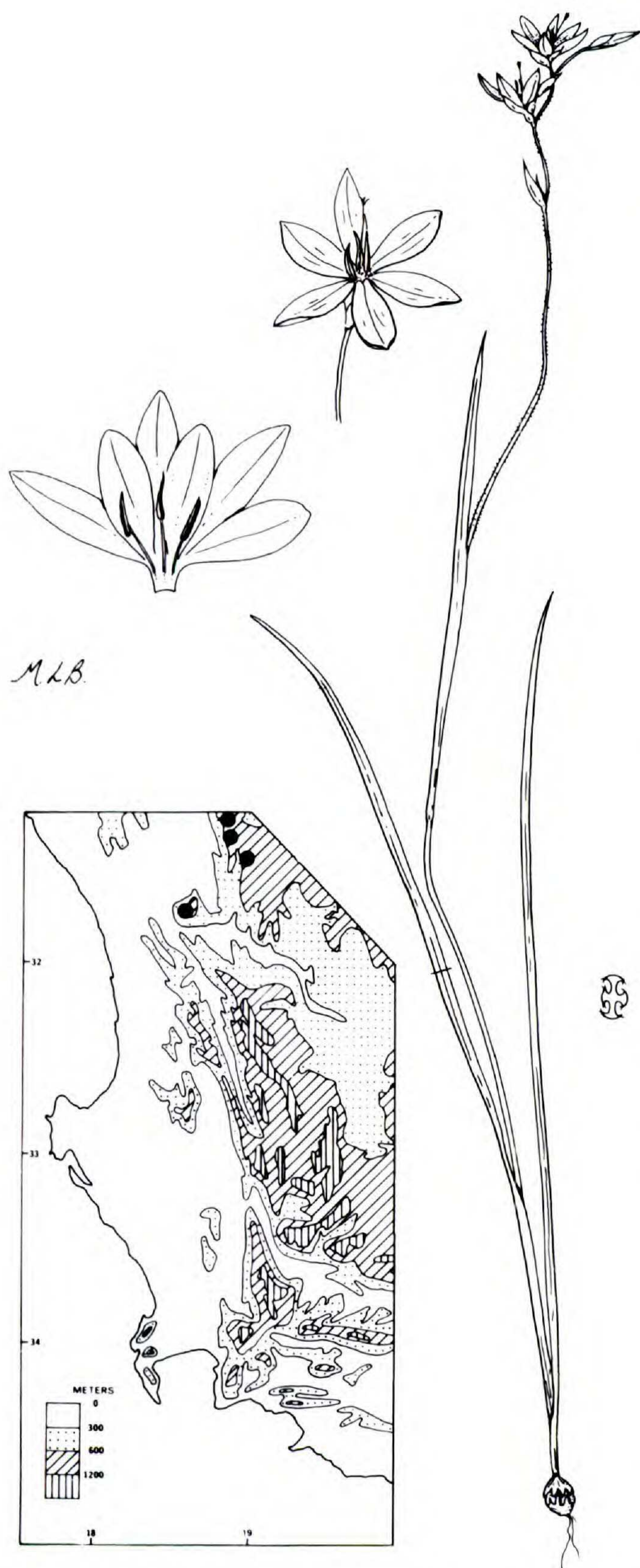


FIGURE 79. Morphology and distribution of *Geissorhiza arenicola*. Habit $\times 0.5$; intact flower life size; opened flower $\times 1.5$; leaf section much enlarged (Goldblatt 7056, heathland W of Nieuwoudtville).

(BA), *Middlemost* s.n. (NBG 60637, SAM 61725); national road outside Plettenberg Bay (AB), Goldblatt 2912 (MO, WAG); Keurbooms River, Galpin 4681 (K, PRE); Plettenberg Bay, Fourcade 4806 (BOL, MO, STE), Salter 6941 (BOL).

3424 (Humansdorp) Oudebos flats (AA), Fourcade 967 (BOL), 3364 (BOL, K, PRE, STE); Krom River,

W of Humansdorp (BA), Acocks 21476 (PRE); duine veld, E of Kromme River mouth (BB), Fourcade 2781 (STE); 4 km E of Humansdorp, Goldblatt 4929 (MO), 5211 (MO, PRE); 8.5 mi. E of Humansdorp on road to Cape St. Francis, Thompson 901 (STE); near Humansdorp, Tyson 3067 (K, SAM, Z), Barker 9068 (NBG), Thode A1038 (PRE), Galpin 4671 (K, PRE).

3425 (Port Elizabeth) Patons farm, Baakens River (DC), Long 470 (K, PRE); Port Elizabeth, Paterson 762 (BOL, PRE), Fries, Norlindh & Weimarck 217 (K, LD, PRE, SAM); Baakens River, Long 441 (K, PRE).

WITHOUT PRECISE LOCALITY: Riversdale (? dist.), Rust 13 (B), 55 (B); Cape of Good Hope (C.B.S.), Sparrman s.n. (S), Bowie 18 (BM).

77. *Geissorhiza arenicola* Goldbl., sp. nov. TYPE: South Africa. Cape: sandy wet heathland west of Nieuwoudtville, Goldblatt 7056 (holotype, MO; isotypes, K, NBG, PRE, S). FIGURE 79.

Planta 12–26 cm alta, tunicis cormi imbricatis duris, foliis 3, inferioribus duobus basalibus linearibus, superiore caulem infra vaginante, caule erecto, pubescenti supra, saepe infra glabro, spica (1–)3–8 florum, floribus stellatis, albis vel caeruleo-malvinis, tubo 1.5–2 mm longo, tepalis 10–15 mm longis, filamentis inaequalibus, antheris 3–5 mm longis, stylo diviso prope apicem antherarum.

Plants 12–26 cm high. *Corm* globose, 6–10 mm diam., symmetric, tunics blackish, imbricate, woody, notched into regular segments below. *Cataphyll* solitary, membranous. *Leaves* 3, narrow, linear, 1–2 mm wide, reaching the midline of the stem or the base of the spike, the margins and midrib enlarged and thus 2-grooved on each surface, the edges of the margins and midrib minutely ciliate or evidently smooth, often sticky below and with adhering sand, the lower two leaves basal, the uppermost inserted shortly above ground, often largest, sheathing the stem for two-thirds of its length, the sheath several ribbed and somewhat inflated. *Stem* erect, puberulent above the third leaf, smooth below, occasionally with 1 branch, without a sheathing bract. *Spike* flexuose, inclined, (1–)3–8-flowered; *bracts* herbaceous, the margins often lined with red above, sometimes becoming dry and membranous from the apex, 7–9 mm long, the inner shorter and much narrower than the outer. *Flower* stellate, white or deep blue-mauve and then pale in the throat; *perianth tube* 1.5–2 mm long, enclosed in the bracts, infundibuliform; *tepals* 10–15 mm long, 4–8 mm wide, oval. *Filaments* slightly unequal, 3–4 mm long, one 1–1.5 mm shorter than the other two; *anthers* 3–5 mm long, pale yellow. *Ovary* 1.5–2 mm long, *style* dividing at the apex of the anthers, branches ca. 2 mm

long, recurved. *Capsule* unknown. *Chromosome number*, $2n = 26$ (Goldblatt 7056).

Flowering time. September to mid-October.

Distribution. Nieuwoudtville Escarpment, between Grasberg and Lokenberg, and on the Gifberg, in stony Cape mountain soil. Figure 79.

Geissorhiza arenicola is endemic to the Gifberg and Nieuwoudtville Escarpments where it grows in the rocky, poor sandstone-derived soil typical of the mountains of the Cape System. It is nowhere common, but has been collected at four places along the Nieuwoudtville Escarpment as well as on the Gifberg a short distance to the southwest. *Geissorhiza arenicola* is distinctive in its puberulent stem; heavily ribbed and grooved upper leaf sheath; sticky basal leaves with strongly raised margins; and slightly to distinctly unequal stamens. While blue is the usual flower color, the collection from Lokenberg, *Acocks* 17251, is described as having white flowers.

It is apparently related to the better known and striking, brilliant blue-flowered *Geissorhiza splendidissima* with which it shares several important features, including a puberulent stem; a strongly ribbed and grooved upper leaf sheath; short perianth tube; and basal leaves with strongly raised margins and midrib, the edges of which are usually lightly ciliate. These two species have been assigned to section *Ciliata*, but as discussed under *G. splendidissima*, they are exceptional in this alliance in their strongly ribbed upper leaf sheath, a characteristic of section *Geissorhiza*. *Geissorhiza arenicola* shows some resemblance to the Nieuwoudtville endemic, *G. sulphurascens*, a species which has creamy yellow flowers and a smooth stem. The similarity is probably coincidental, and the two species can always be distinguished by several different characters.

Specimens examined. SOUTH AFRICA. CAPE: 3118 (Vanhynsdorp) Gifberg (DC), *Phillips* 7518 (NBG, PRE, STE).

3119 (Calvinia) Nieuwoudtville Escarpment in fynbos W of town, 3 km S of the Calvinia road (AC), *Goldblatt* 5837 (MO); 5 mi. NW of Nieuwoudtville on Grasberg road, *Barker* 9560 (M, NBG); wet sandy heathland W of Nieuwoudtville, *Goldblatt* 7056 (K, MO, NBG, PRE, S); wet sandy meadows, Bokkeveld, *Marloth* 7641 (PRE); Lokenberg, arid fynbos (CA), *Acocks* 17251 (PRE).

78. *Geissorhiza splendidissima* Diels, Bot. Jahrb. Syst. 44: 117. 1909; Foster, Contr. Gray Herb. 135: 31. 1941. TYPE: South Africa.

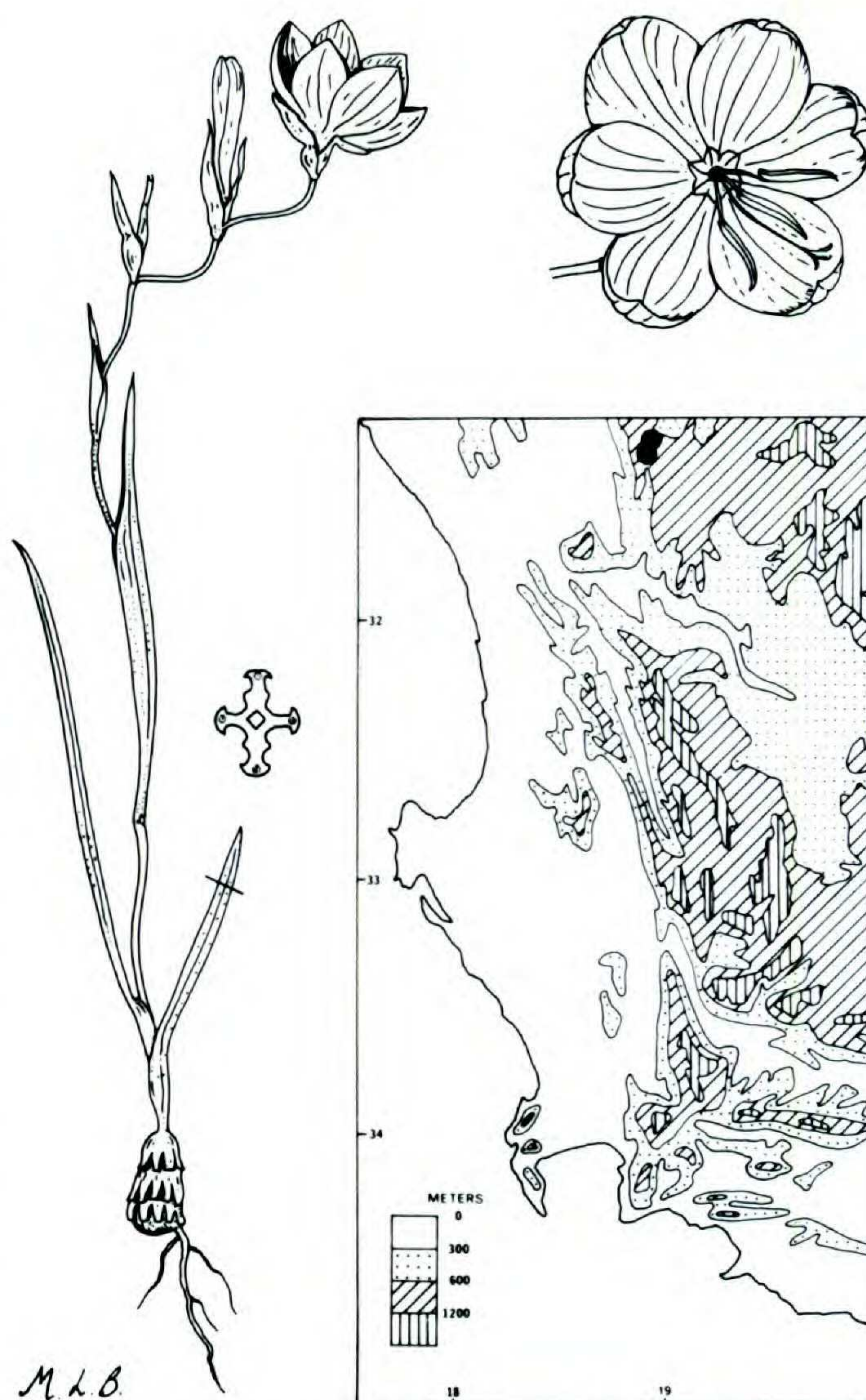


FIGURE 80. Morphology and distribution of *Geissorhiza splendidissima*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt s.n.*, Glenlyon farm, Nieuwoudtville).

Cape: Oorlogskloof, *Diels* 627 (holotype, B). FIGURES 12, 80.

Plants 8–20 cm high. *Corm* ovoid, truncate at base, 7–10 mm diam., tunics dark, imbricate, the outer layers incised below into regular truncate segments. *Cataphyll* not evident. *Leaves* 3, linear, shorter to slightly longer than the stem, (1–)1.5–2 mm wide, the margins raised and extending at right angles to the blade, the midrib thickened, the blade thus narrowly 2-grooved on each surface, the edges of the margins and the midrib minutely ciliate, slightly sticky and with sand adhering in places, the lower two leaves basal, the lowermost longest, the uppermost inserted shortly above the ground, sheathing the stem below, wider than the basal leaves, the sheath somewhat inflated. *Stem* erect, densely and minutely puberulent, sheathed below and with a short bract leaf above, simple or with a single, or rarely 2 branches. *Spike* (1–)2–5(–6)–

flowered, flexed at the base of the spike; *bracts* green, becoming dry and brown from the apex, the outer 16–20(–25) mm long, the inner 8–16 mm long. *Flower* deep blue-violet, darker towards the base of the tepals, and yellowish in the throat, tepals cupped, zygomorphic, the stamens unilateral and declinate, held above the dorsal tepal; *perianth tube* 2–4 mm long, widening from the base; *tepals* broadly ovate, 15–22 mm long, outer 9–14 mm wide, inner 8–12 mm. *Filaments* ca. 5 mm long, equal, unilateral and declinate; *anthers* unilateral, horizontal, lying over the dorsal tepal, 7–8 mm long, pollen red-brown. *Ovary* ca. 3 mm long, *style* 10–11 mm long, lying below the stamens, dividing at the apex of the anthers, branches 2 mm long, recurved. *Capsule* globose, 6–7 mm long, to 5 mm diam., enclosed in the bracts. *Chromosome number*, $2n = 26$ (Goldblatt 347).

Flowering time. Late August to September.

Distribution. Sandy to stony flats to the north and south of Nieuwoudtville, east of the escarpment above Van Rhyns Pass. Figure 80.

Geissorhiza splendidissima is endemic to the area immediately around Nieuwoudtville in the northwestern Cape, where it grows in light clay soil among low-growing shrubs. It flowers well only when the surrounding vegetation has been cleared or disturbed and then it may make a striking display. The large, glossy deep blue-violet flowers are amongst the most beautiful in the genus and the species is well worth horticultural attention.

The affinities of *Geissorhiza splendidissima* seem to be with section *Ciliata*, the species of which have similar leaf morphology, with strongly raised margins and winged margins that are ciliate on the edges. Its puberulent stem is also consistent with this disposition for several species of the section also have this feature. The zygomorphic flowers of *G. splendidissima* are unique in the section and must be regarded as having evolved independently in this species and not indicative of a relationship to other sections in which there are species with similar zygomorphic flowers. It is somewhat unusual in section *Ciliata* also in the somewhat ribbed sheath of the uppermost leaf. This character is shared with the apparently allied *G. arenicola* and this seems to set these two species somewhat apart in the section.

Specimens examined. SOUTH AFRICA. CAPE: 3119 (Calvinia) Nieuwoudtville-Grasberg road (AC), Gold-

blatt 347 (BOL); ca. 1 mi. N of Nieuwoudtville, *L. Bolus s.n.* (BM, BOL 19439, K); Nieuwoudtville, *Salter 1645* (BM), *Buhr s.n.* (Nat. Bot. Gard. 636/29 in BOL, Nat. Bot. Gard. 300/37, 299/39 in NBG, 822/30 in K); cult. in hort. Martley, Banhoek, ex Nieuwoudtville, *Buhr s.n.* (BOL), *Loubser 945* (NBG); Grasberg, 15 mi. NW of Nieuwoudtville, *Barker 9549* (NBG, UC); Charlies Hoek, *Barker 10759* (NBG); between Oorlogskloof and Papkuilsfontein, *Leipoldt 3035* (BOL, PRE); Willemsrivier, Calvinia, *Leipoldt 817* (SAM); Bokkeveld, Oorlogskloof, *Diels 627* (B); Glenlyon farm, Nieuwoudtville, *Hardy 67* (G, K, PRE, Z).

79. *Geissorhiza inflexa* (de la Roche) Ker, Ann. Bot. (König & Sims) 1: 224. 1804; Baker, Handb. Irid. 157. 1892, Fl. Cap. 6: 73. 1896, non sensu Baker (intended for *G. imbricata* sensu lato); Goldblatt & Barnard, J. S. African Bot. 36: 296–298. 1970. *Ixia inflexa* de la Roche. Descr. Pl. Aliq. Nov. 15. 1766. *Hesperantha inflexa* (de la Roche) Foster, Contr. Gray Herb. 135: 77. 1941, excl. basion. [name misapplied to *Hesperantha vaginata* (Sweet) Goldbl.]. TYPE: South Africa. Cape: Cape Peninsula, *Barker 3869* [neotype, BOL, designated by Goldblatt & Barnard (1970); isoneotype, NBG]. FIGURE 81.

Ixia hirta Thunb., Diss. de *Ixia* no. 6. 1783, hom. illeg. superfl. pro *I. inflexa* de la Roche. *Geissorhiza hirta* (Thunb.) Ker, Ann. Bot. (König & Sims) 1: 224. 1804; Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 71. 1896, nom. illeg. basion. illeg. superfl.

Ixia erosa Salisb., Prod. 36. 1796. *Geissorhiza erosa* (Salisb.) Foster, Contr. Gray Herb. 135: 52. 1941. TYPE: South Africa. Origin unknown: cultivated in England [location of type unknown, possible isotype at G (Herb. DC)].

Ixia ciliaris Salisb. ex Ker, Bot. Mag. 18: sub. tab. 672. 1803, nom. nud. in syn. [*Ixia ciliaris* and therefore *G. ciliaris* are apparently based on a specimen collected by *Auge s.n.* (BM), annotated "*Ixia ciliaris* Salisb. Prod." (probably in Salisbury's hand). It is the large, red- or purple-flowered form of *G. inflexa*.]

Geissorhiza (as *Gissorhiza*) *ciliaris* Salisb., Trans. Hort. Soc. London 1: 321. 1812, nom. nud. (apparently intended as a combination in *Geissorhiza* of "*Ixia ciliaris* Salisb., Prod. 36. 1796," a name never published—possibly Salisbury changed the epithet in print: *Ixia erosa* Salisb., which is conspecific, appears on the page cited in his Prodrum).

Geissorhiza ciliaris (Ker) Jackson, Index Kew. 1: 1006. 1895, nom. nud. basion. inval.

Geissorhiza rosea Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 20. 1827. TYPE: South Africa. Cape: near Tulbagh, cultivated in Cape Town, *Ecklon s.n.* [lectotype, S, designated by Nordenstam (1970)].

Geissorhiza candida Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 21. 1827. TYPE: South Africa. Cape: Hottentots Holland, *Zeyher s.n.* (lectotype, S).

Geissorhiza quinquangularis Ecklon ex Klatt, Linnaea

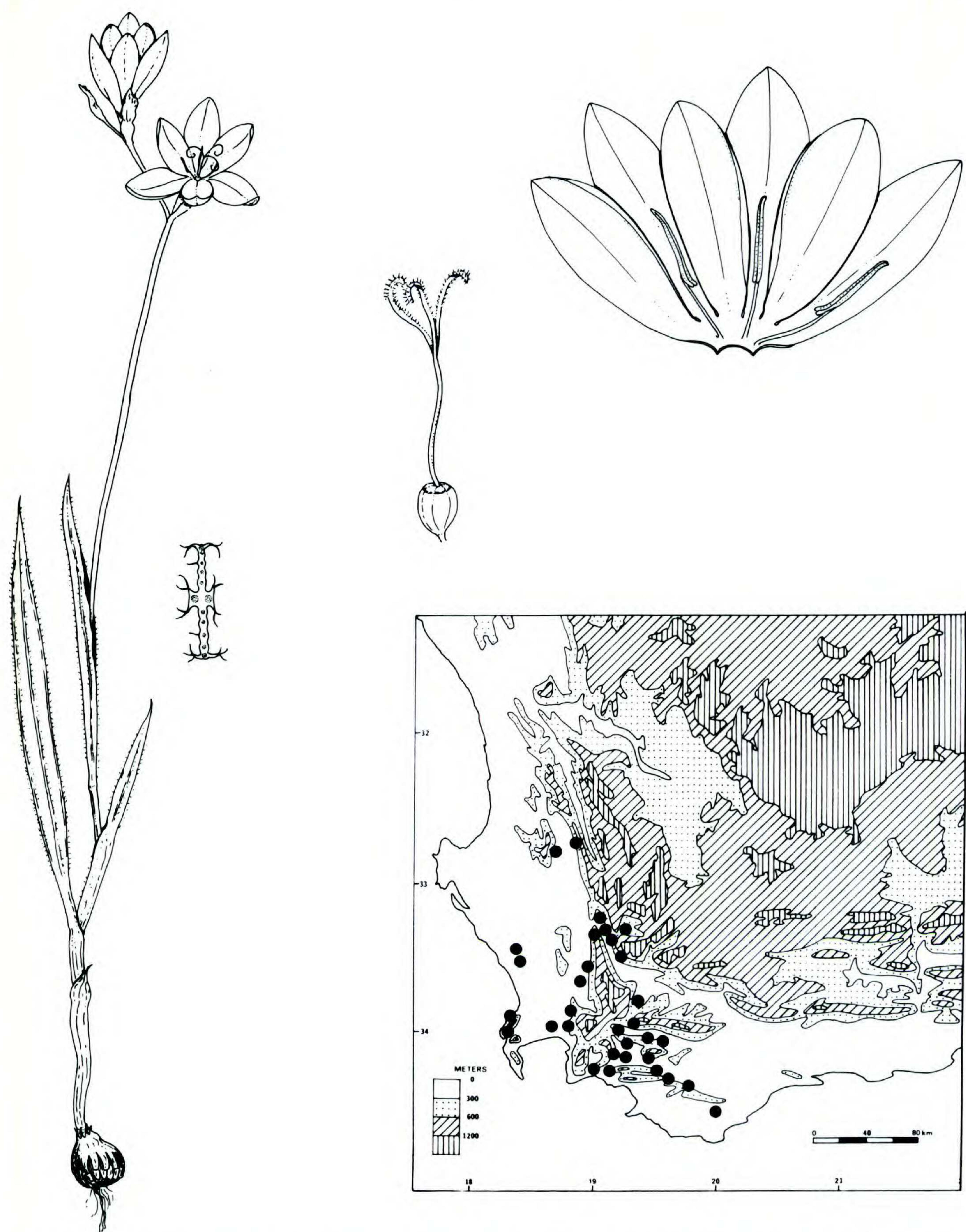


FIGURE 81. Morphology and distribution of *Geissorhiza inflexa*. Habit life size; opened flower and gynoecium $\times 2$; leaf section much enlarged (*Goldblatt 5643*, N of Bot River).

34: 654. 1865; Foster, *Contr. Gray Herb.* 135: 53–54. 1941, nom. superfl. pro *G. rosea* Ecklon if this species is accepted as validly described, as here. [Specimens cited in the description are: *Ecklon & Zeyher Irid.* 214 (Caledon Zwarteberg), the

sheet designated by Foster (1941: 54) as the lectotype; *Ecklon & Zeyher Irid.* 215; *Ecklon & Zeyher Irid.* 296; and *Lalande s.n.*] *Hesperantha kermesina* Klatt, *Abh. Naturf. Ges. Halle* 15: 395 (Erg. 61). 1882. *Geissorhiza erosa* var.

kermesina (Klatt) Foster, Contr. Gray Herb. 135: 53. 1941. TYPE: South Africa. Cape: between Paarl and Pont, Drège 8480 [lectotype, B, effectively designated by Foster (1941: 53); islectotypes, B, BM, G, K, L, MO, SJ].

Hesperantha quinquangularis Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 23. 1827, nom. nud.

Geissorhiza graminifolia Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 70. 1896. TYPE: South Africa. Cape: near Swellendam, Drège 3496 (lectotype, K, here designated; islectotypes, B, E, G, L, MO, P); near George, Burchell 6088 (syntype, K = *G. heterostyla*).

Geissorhiza graminifolia var. *bicolor* Baker, Handb. Irid. 155. 1892, Fl. Cap. 6: 70. 1896. TYPE: South Africa. Cape: Hout Bay, MacOwan in Herb. Norm. Austr. Afr. 261 (lectotype, K, here designated; islectotypes, B, BOL, G, SAM; syntypes, see Flora Cap. 6: 70. 1896).

Geissorhiza quinquangularis var. *atrofaux* Foster, Contr. Gray Herb. 135: 55. 1941. TYPE: South Africa. Cape: Piketberg, Schlechter 5210 (holotype, B; isotypes, B, BM, G, K, SAM, W, Z).

Geissorhiza pilosa Pappe ms. [Cape Flats, Pappe s.n. (SAM)].

Plants (5–)12–30(–40) cm high. *Corm* symmetric, 7–12 mm diam., tunics blackish, imbricate, the outer layers notched regularly below into segments. *Cataphyll* membranous, dark above. *Leaves* 3, usually half to two-thirds as long as the stem, sometimes exceeding the spike linear-ensiform, (1.5–)3–4(–10) mm wide, the margins extended outward at right angles to the blade, the midrib also raised and winged, the edges of the margins and midrib and sometimes other larger veins ciliate-pubescent, the lower two leaves basal, the uppermost basal or more often cauline, sheathing for most of its length, the sheath ribbed and ciliate-pubescent, slightly inflated. *Stem* erect, smooth, sheathed below by the uppermost leaf, rarely branched. *Spike* (1–)2–6-flowered, flexed at the base; *bracts* membranous, dry, reddish brown, occasionally greenish below, 7–15(–22) mm long, the inner somewhat smaller than the outer. *Flowers* stellate, either purple, pink, red, or white, cream or pale yellow and then usually red-flushed on the reverse of the outer tepals and occasionally dark in the center; *perianth tube* short 1–2.5 mm long; *tepals* (8–)10–18(–24) mm long, obovate, 8–10 mm at widest. *Filaments* 4–7 mm long, equal; *anthers* (2.5–)3–6(–8) mm long. *Ovary* 2–3 mm long, *style* dividing near the apex of the anthers, branches ca. 4–5 mm long, recurved above. *Capsule* globose to oblong, 3–6 mm long. *Chromosome number*, $2n = 26$ (Goldblatt 2497, 6173), $2n = 26 + 1B$ (Goldblatt 5228).

Flowering time. August to September

Distribution. Southwestern Cape, from Bredasdorp and Swellendam in the east to the Cape Peninsula and north to Piketberg, extending inland in the Tulbagh and Worcester valleys. Figure 81.

Geissorhiza inflexa was described in 1766 by Daniel de la Roche in an important publication, actually his doctoral dissertation, in which 20 species of Cape Iridaceae were described. Placed in the genus *Ixia*, it was misinterpreted by Baker (1892, 1896) who cited specimens of *G. imbricata* under this name and by Foster (1948) who confused it with the large yellow-flowered *Hesperantha vaginata* from the Calvinia district in the northern Cape. Authentic material at the Leiden Herbarium (Goldblatt & Barnard, 1970) makes it quite clear that *I. inflexa* is a species of *Geissorhiza*, as realized by Ker in 1804. It is conspecific with what was long known as *G. quinquangularis*, or *G. graminifolia*. A neotype, Barker 3869 from the Cape Peninsula, a good match for the material at Leiden, was designated by Goldblatt and Barnard.

The species is common in the southwestern Cape on clay and shale slopes and sometimes is found on very stony ground. It extends from Bredasdorp and Swellendam in the east to the Cape Peninsula and Mamre and northward to the Piketberg district with inland extensions into the Tulbagh and Worcester valleys. It belongs to section *Ciliata* of subgenus *Geissorhiza*, the species of which have leaves with a raised margin which extends at right angles to the blade and itself has ciliate edges. The midrib is also slightly raised and winged with ciliate edges. Occasionally one or more secondary pairs of veins may also be ciliate. Of the group, *G. inflexa* seems one of the more specialized, having few flowered spikes and only occasionally branched stems. It always has three leaves and lacks the stem bract found in some of the other species of the group. The flowers are moderate to large in size, and range in color from cream to pale yellow with pink or red on the reverse of the outer tepals to shades of pink, red, or purple. *Geissorhiza heterostyla*, a southern Cape species that extends north into the western Karoo is closely allied, but can readily be distinguished by its one filament much shorter than the others, a more branched inflorescence, and conspicuous dry stem bracts below the spike.

There is a tendency for reduction in flower size

and narrowing of the leaves in populations of *Geissorhiza inflexa* towards the east of its range, south and east of Caledon. At Bredasdorp specimens seem very different from the robust plants that occur at Tulbagh, and it is easy to see why earlier authors should have recognized these as separate species. However, the narrowest leaved form which is found at Bredasdorp, with leaves 1–2 mm wide and flowers with tepals ca. 9 mm long (*Wasserfall* 376, *Barker* 2527, 2475, *Compton* 9094) is connected through a series of intermediates to the type specimens of *G. quinquangularis* (leaves 3 mm wide, tepals 15 mm long) and *G. inflexa* (leaves 4–6 mm wide, tepals to 12 mm long). The latter specimen in turn matches, except in flower color, several collections from Stellenbosch, Mamre, and Tulbagh, with purple or red flowers [e.g., *Leighton* 1338, *Zeyher s.n.* (SAM 20861), *Mathews* 10, *Grant* 2459 (leaves 5–8 mm wide, tepals to 14 mm long)] which are clearly conspecific with such strikingly robust specimens as *Lewis* 5335, 5740, *MacOwan s.n.* (Herb. Norm. Austr. Afr. 590) (leaves 5–10 mm wide, tepals 18–20 mm long).

Traditionally the red, pink, or purple and robust form of *Geissorhiza inflexa* has been regarded as a species distinct from plants with white to cream flowers marked red on the reverse of the outer tepals. Baker (1892, 1896) recognized pink- to purple-flowered plants as *G. hirta* (an illegitimate name) and the paler flowered and often slender plants as *G. graminifolia*. The latter is actually based on two collections, one, *Burchell* 6088, is *G. heterostyla* and the other, a Drège collection, here designated the lectotype, matches several other specimens of *G. inflexa* cited in "Flora Capensis." The Drège collection corresponds closely to the type material of *G. quinquangularis* Ecklon ex Klatt, a much earlier name, and the one used by Foster in his monograph for this form. Foster used the name *G. erosa* for the robust, and red- to purple-flowered plants as he realized *G. hirta* was superfluous and illegitimate.

The recognition of the two forms as separate species seems unjustified, as it is based largely on color differences. Specimens with cream flowers from the Cape Peninsula, and north of Cape Town, as well as the type collection of *G. quinquangularis* match some of the less robust, red-flowered specimens of *G. erosa-hirta* in every respect except flower color, and separation of species on color differences alone is unacceptable, and especially since cream-flowered speci-

mens occur occasionally in populations of the red-flowered form from Tulbagh (*Lewis* 5738, *Garside* 1541). These two forms are consequently united here in one species, the earliest name for which is *G. inflexa*. There is obviously intense selection for red flower color in the Tulbagh valley, and several species of *Iridaceae*, elsewhere white- or blue-flowered, have flowers in red to purple colors here (e.g., *Sparaxis grandiflora*, *Babiana villosa*, and *Galaxia versicolor*).

Similar selection for a cream (to pale yellow) flower with a dark center and throat is evident along the coastal belt north of Cape Town especially in the Piketberg-Porterville area and populations of *Geissorhiza inflexa* here also have pale flowers with a dark center. This form was recognized by Foster (1941) as *G. inflexa* var. *atrofaux*. It seems to me no more than a minor color variant, and not worth taxonomic recognition. Loubser has recorded probable hybridization between this form of *G. inflexa* and *G. tulbaghensis* where they occur together on a farm northwest of Porterville, also in association with *G. secunda*. *Loubser* 2188 and 2104 have large flowers with a red throat, a character of *G. tulbaghensis*, while *Loubser* 2102 has self-colored flowers.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) Piketberg Mt. (DC), *Schlechter* 5210 (B, BM, G, K, SAM, W, Z); Nurust farm 8 mi. NW of Porterville (DD), *Loubser* 2102 (BOL), 2188 (NBG).

3318 (Cape Town) Contreberg slopes (AD), *Pillans* 6945 (BOL); Mamre hills, *Barker* 1813 (NBG); Groenekloof, *Zeyher s.n.* (SAM 20861), *MacOwan in Herb. Norm. Austr. Afr.* 590 (B, BOL, G, GH, K, SAM); near Cape Town (CD), *H. Bolus* 4805 (BOL, K); Signal Hill, *Barker* 405 (NBG), *Wolley Dod* 521 (BM, BOL, K); Signal Hill, above Tamboers Kloof, *Michell s.n.* (NBG), *Salter* 7629 (CT, SAM); Lions Head, *Ecklon* 312 (B, E, K, M, MO, S, Z); Lions Rump, *Thode* 8457 (STE); Table Mt., *MacOwan s.n.* (S); Wellington (DB), *Grant* 2376 (BOL, M, MO); near Wellington, *Dümmer* 2840 (E); Stellenbosch (DD), *Ecklon & Zeyher Irid.* 215 (87) (FI, G, MO); near Stellenbosch, *Lightfoot s.n.* (BOL 3194); between Paarl and Pont, *Drège* 8480 (B, BM, G, K, L, MO, S); Onderpapagaisberg, lower slopes, *Taylor* 6882 (STE); Jonkershoek, *Garside* 1531 (K); Jonkershoek valley, *Lewis* 1995 (SAM); Stellenbosch, *Duthie* 585 (BOL), *Worsdell s.n.* (K); Paarl, *Loubser* 467 (NBG).

3319 (Worcester) Tulbagh (AC), *Hall* 1426 (NBG), *Grant* 2459 (MO), *Marloth* 7801 (PRE), 8909 (PRE), *Garside* 1541 (K), *Rogers* 11097 (Z), *MacOwan* 2678 (E, K); 2 mi. S of Tulbagh, stony clay flats, *Lewis* 5740 (NBG); S-facing hill slopes on clay at Tulbagh, *Lewis* 5738 (NBG, STE); lower slopes of the Witsenberg, *Leighton* 1338 (BOL, NBG); foot of the Witsenberg near Michells Pass, *Goldblatt* 4077 (MO); Tulbagh cemetery, *Goldblatt* 5228 (MO); 1 mi. S of Tulbagh

Road Station, *Goldblatt 304* (MO); near Artois, *H. Bolus s.n.* (BOL); Ceres, *Reyneke 12* (BOL); Ceres Road (Wolseley), *Schlechter 8975* (B); 3 mi. from Hermon on Tulbagh road, *Marsh 738* (PRE, STE); Slanghoek valley (CA), *Barker 9470* (NBG); shale hills between Villiersdorp and Brandvlei (CD), *Goldblatt 6203* (MO).

3418 (Simonstown) near Hout Bay neck (AB), *MacOwan in Herb. Norm. Aust. Afr. 261* (B, BM, BOL, G, K, SAM, W) = *MacOwan 2632* (SAM); Cape Flats (BA), *Pappe s.n.* (K, SAM); Hottentots Holland (BB), *Ecklon & Zeyher Irid. 214* (91.8) (K, SAM); wet flats at Gordons Bay, *H. Bolus 9939* (BOL, K, PRE, Z); near Faure at Macassar Beach turnoff, *Jackson s.n.* (NBG 88444); near Oudebos farm, Palmiet River Valley, shale band (BD), *Boucher 1894* (PRE, STE).

3419 (Caledon) N of Bot River (AA), *Goldblatt 5643* (BR, MO, US, WAG), *Goldblatt 4982A* (MO); Bot River-Caledon road via Goedvertrou, *Goldblatt 3996* (MO); clay slope W of Eseljag Pass on road to Queen Anne, *Goldblatt 2497* (K, MO, PRE, S, US, WAG); stony clay flats S of Villiersdorp at Theewater farms turnoff (AB), *Goldblatt 4015* (MO, NBG); between Caledon and Villiersdorp, at Riviersonderend bridge, *Salter 4793* (BM, BOL, K); Caledon (AB), *Barker 2495* (NBG); commonage below Zwartberg, Caledon, *Guthrie s.n.* (BOL); lower S slopes of Swartberg, Caledon, *Esterhuysen 32670* (BOL, MO), *Ecklon & Zeyher Irid. 214* (51.8) (B, BR, E, FI, G, LD, W, Z), *Schlechter 5561* (B, PRE, Z); Caledon Zwartberg, slopes above Gardens, *Goldblatt 5896* (MO, WAG); clay slope on W outskirts of Caledon, *Goldblatt 6173* (MO); 18.4 km SW of Greyton, *Acocks 24340* (K, MO, PRE); Albertyn-Caledon road near Leeurivier (AC), *Goldblatt 4837* (MO, US); Fernkloof, Hermanus (AD), *Goldblatt 5176* (MO, PRE); Fairfield (BD), *Lewis 5286* (NBG); NE of Sandys Glen, near Fairfield, *Goldblatt 4848* (MO); The Poort, SW of Bredasdorp (DB), *Wasserfall 378* (NBG), *Goldblatt 4862A* (MO), *Barker 2475* (NBG), 2527 (NBG), *Acocks 24238* (EA, STE); Poort hills, Bredasdorp, *Compton 9094* (NBG).

WITHOUT PRECISE LOCALITY: Breede River, near Swellendam, *Drège 3496* (B, BM, E, G, K, L, MO); Cape of Good Hope (C.B.S.), *Herb. Burman s.n.* (G), *Thunberg s.n.* (*Ixia hirta*) (S "Herb. Montin," UPS), *Roxburgh s.n.* (BM), *Pappe s.n.* (BM), *Prior s.n.* (K).

80. *Geissorhiza erubescens* Goldbl., sp. nov.

TYPE: South Africa. Cape: Pakhuis Pass, on shale slopes near top of pass, *Goldblatt 6396* (holotype, MO; isotypes, K, NBG, PRE, S, WAG). FIGURE 82.

Planta (5-)8-15 cm alta, foliis 3, duobus inferioribus basalibus erectis linearibus, floribus (1-)3-7, albis, rubris in reverso tepalorum exteriorum, tubo 1.5-2 mm longo, tepalis 8-12 mm longis, filamentis aequalibus, antheris 2.5-3 mm longis, stylo diviso prope apicem antherarum, ramis recurvatis.

Plants (5-)8-15 cm high. *Corm* more or less globose, obliquely flattened below, 5-12 mm diam., tunics blackish, imbricate, notched regularly below into segments. *Cataphyll* firm,

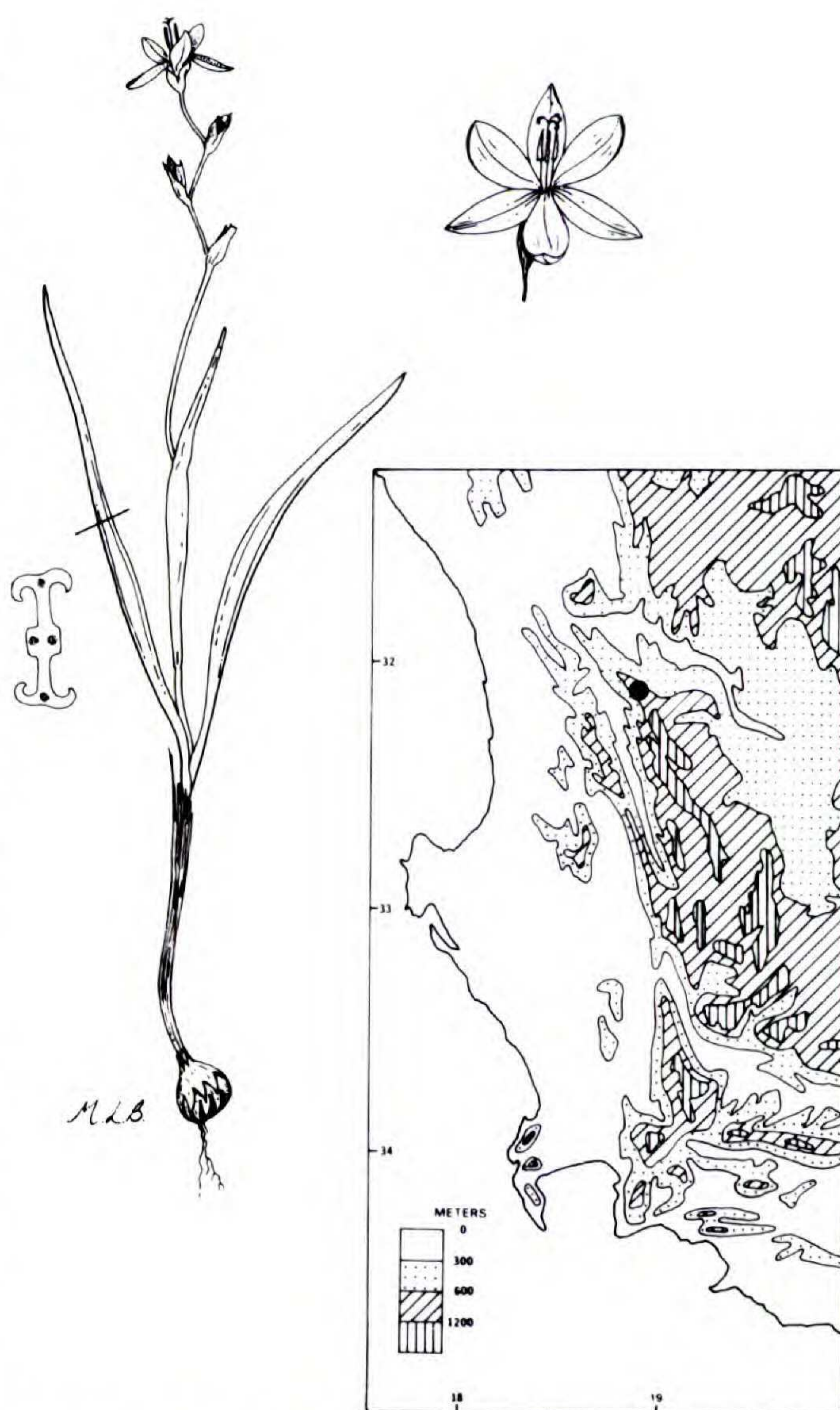


FIGURE 82. Morphology and distribution of *Geissorhiza erubescens*. Habit $\times 0.5$; flower life size; leaf section much enlarged (*Goldblatt 6396*, Pakhuis Pass).

brownish, persistent, and accumulating with leaf bases in a fibrous neck around the stem base in older individuals. *Leaves* 3, linear and erect, 2-3 mm wide, half to two-thirds as long as the stem, the margins raised with wings extending at right angles to the blade, the midrib also raised and winged, minutely ciliate to visibly pubescent on the edges of the margins, midrib, and sometimes other veins, the lower two leaves basal, the uppermost leaf largest and inserted in the middle part of the stem, sheathing below. *Stem* erect, ciliate to pubescent below the third leaf, ciliate or smooth above, simple or 1-branched. *Spike* flexed at the base, (1-)3-7-flowered, flexuose; *bracts* membranous and greenish to transparent below, rust brown above, 6-8 mm long, flexed outward in the midline, the inner shorter than the outer. *Flowers* stellate, creamy white, bright red on the reverse of the outer tepals; *perianth*

tube 1.5–2 mm long, much shorter than the bracts; tepals 8–12 mm long, ovate-elliptic, 3–4 mm wide. Filaments equal, ca. 3 mm long; anthers 2.5–3 mm long, cream. Ovary 1–2 mm long, style dividing at the apex of the anthers, branches recurved. Capsule unknown. Chromosome number, $2n = 26$ (Goldblatt 6396).

Flowering time. September.

Distribution. Known only from Pakhuis Pass, common on the shale band, especially after fires. Figure 82.

Geissorhiza erubescens is a distinctive small-flowered species of section *Ciliata*, probably most closely allied to the southwestern Cape *G. inflexa* and to *G. leipoldtii* which occurs in the same general area as *G. erubescens*. It can be distinguished by the unusual sheath of fibers around the stem base, at least in older individuals; relatively small flowers with tepals 8–12 mm long; strongly winged leaf margins; and its lightly ciliate-pubescent stem, at least below the uppermost leaf. It is perhaps closest to *G. leipoldtii* which sometimes has unequal stamens and typically larger flowers, the tepals (13–)18–28 mm long, without the deep red markings on the reverse of the outer tepals characteristic of *G. erubescens*. It also bears some resemblance to the Nieuwoudtville and Gifberg species, *G. divariata*, but this typically has distinctive, dry stem bracts and always has a smooth stem.

Geissorhiza erubescens has been collected only in the upper part of Pakhuis Pass in the shale band, growing in a light sandy clay gravel. When I found it in 1981 it was flowering in profusion in the season following a veld fire. It seems likely that it flowers only in the spring after a burn.

Specimens examined. SOUTH AFRICA. CAPE: 3219 (Wuppertal) E slopes of Pakhuis Pass (AA), Compton 19964 (NBG); Pakhuis Pass, near top of pass on shale slopes, Goldblatt 6396 (K, MO, NBG, PRE, S, US, WAG), Goldblatt 6397 (MO).

81. *Geissorhiza leipoldtii* Foster, Contr. Gray Herb. 135: 47. 1941. TYPE: South Africa. Cape: Pakhuis-Wuppertal road, *Leipoldt s.n.* (holotype, BOL 20778 in K; isotype, BOL). FIGURE 83.

Geissorhiza ixioides Schltr. ex Foster, Contr. Gray Herb. 135: 43–44. 1941. TYPE: South Africa. Cape: "Agtertuin, in collibus," Schlechter 10866 (holotype, B; isotypes, BM, BOL, BR, E, G, K, L, LD, MO, P, PH, PRE, S, Z).

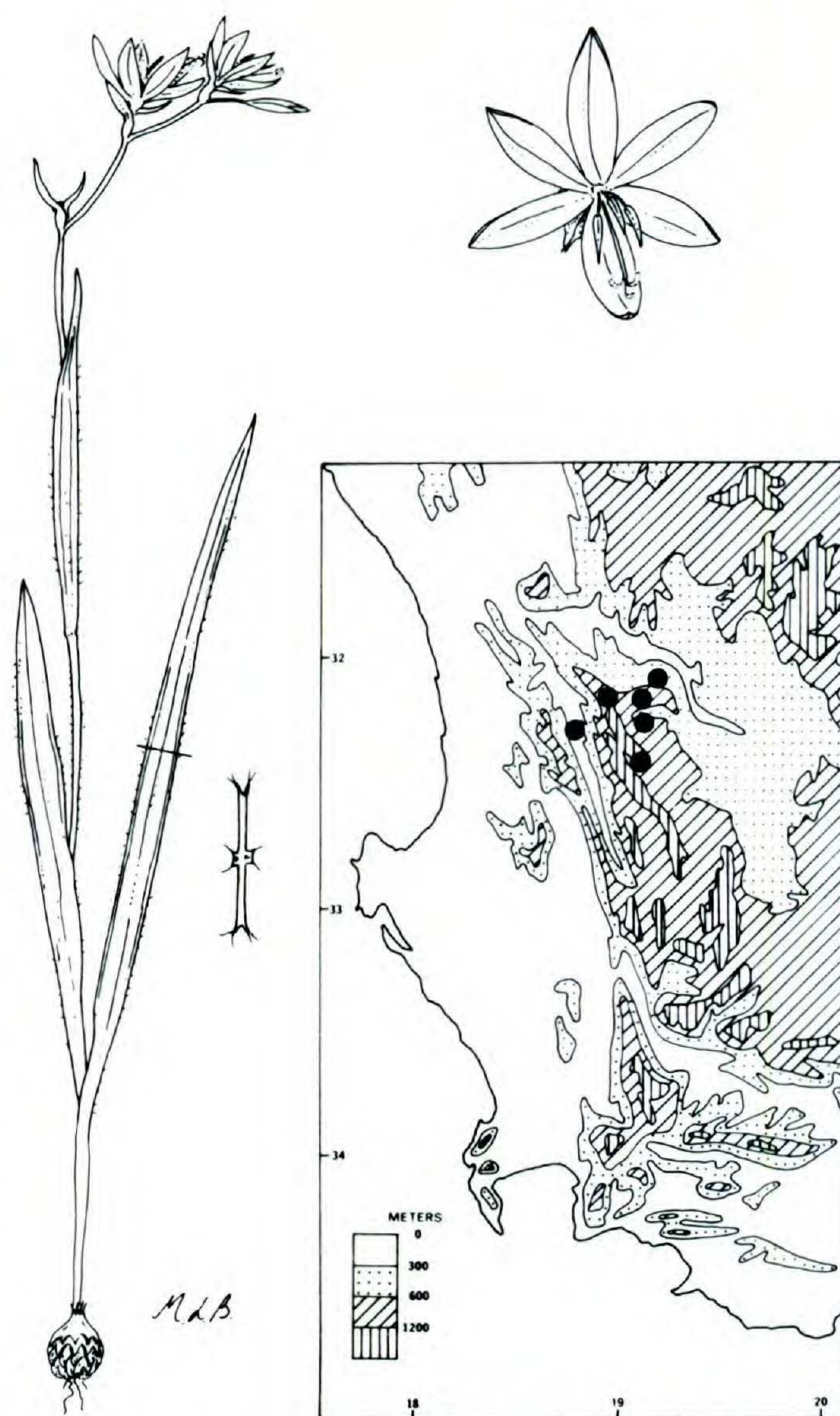


FIGURE 83. Morphology and distribution of *Geissorhiza leipoldtii*. Habit $\times 0.5$; flower life size; leaf section much enlarged (Goldblatt 6165, S of Clanwilliam).

Plants (12–)16–30 cm high. *Corm* symmetric, globose, 5–8 mm diam., tunics dark brown to blackish, imbricate, the outer layers regularly notched below into segments. *Cataphyll* solitary, membranous, brownish above. *Leaves* 3, linear to ensiform, 3–5 mm wide, usually shorter than the stem, apparently plane but the margins raised at right angles to the blade and winged, ciliate along the edges, the midrib also slightly raised and winged, sparsely ciliate along the edges, the lower two leaves basal, the uppermost inserted above the ground and sheathing for at least half its length. *Stem* erect, sparsely puberulent to ciliate, simple or 1-branched. *Spike* flexed at the base of the spike, 2–6-flowered, flexuose; *bracts* membranous, dry and pale brown above, greenish below, 10–16(–22) mm long, the inner smaller than the outer. *Flowers* somewhat cupped,

white or pale pink to purple (often becoming pink with age), apparently dark in the throat in the type population of *G. ixioides*; *perianth tube* 1.5–2 mm long; *tepals* narrowly obovate, (13–)18–28 mm long, 7–10 mm wide. *Filaments* either equal and 5–6 mm long or unequal with one shorter and 2.5 mm long; *anthers* 6–8 mm long, yellow. *Ovary* ca. 2 mm long, *style* dividing towards the apex of the anthers, branches 3–6 mm, recurved. *Capsules* unknown. *Chromosome number*, unknown.

Flowering time. August to September.

Distribution. Shale soils especially on south-facing slopes in the Olifants River Valley and the mountains east of Pakhuis Pass. Figure 83.

Geissorhiza leipoldtii is native to the arid hills of the Olifants River and northern Cedarberg Mountains and its foothills east of Pakhuis Pass. It is evidently allied to the southwestern Cape species *G. inflexa* and it resembles especially the larger flowered forms of this species. It can, however, readily be recognized by its puberulous or ciliate stems, only sparsely ciliate leaves and often unequal stamens. *Geissorhiza erubescens* is undoubtedly closely allied to *G. leipoldtii*. This endemic of the Pakhuis Mountains has small, white to cream flowers with deep red markings on the reverse of the outer tepals, a distinctive fibrous sheath around the stem base and consistently equal filaments. *Geissorhiza leipoldtii* is poorly collected, probably because plants bloom well only in the years when more favorable rains have fallen. Included in the species are two collections made in the wet spring of 1974 on the upper slopes of Biedouw Pass (*Mauve & Oliver* 82, *Goldblatt* 2540) which are unusually robust and have very large flowers, perhaps owing to particularly good rainfall that year.

Geissorhiza ixioides Foster is here reduced to synonymy. This species was recognized on the basis of its smaller flowers (tepals ca. 13 mm long) with a dark center (possibly an artifact of drying), supposed short style and equal stamens, in contrast to the supposed unequal stamens of *G. leipoldtii*. A tendency can be detected in some recent collections of *G. leipoldtii* to develop a dark color in the center of the flower but this character has no taxonomic significance. Foster described the filaments of *G. leipoldtii* as unequal, one being shorter but examination of the type collection at my disposal including the ample material at BOL, not seen by Foster, has shown the filaments of the type of *G. leipoldtii*

to be essentially equal, while type material of *G. ixioides* has a style of normal length.

A collection from the Olifants River Valley near Clanwilliam, *Goldblatt* 6165, is unusual in having distinctly unequal filaments, one being about half the length of the other two. In the absence of any other differences, this form is included in *Geissorhiza leipoldtii*.

Specimens examined. SOUTH AFRICA. CAPE: 3218 (Clanwilliam) 10 km S of Clanwilliam, clay bank (BB), *Goldblatt* 6165.

3219 (Wuppertal) Pakhuis-Wuppertal road (AA), *Leipoldt s.n.* (BOL 20778, K, SAM); slopes above Welbedacht, *Lewis* 5222 (NBG, STE); road to Wuppertal, near Lubbe's farm, *Martin* 808 (NBG); Pakhuisberg, *Schlechter* 8621 (B, BM, BOL, BR, E, G, H, K, L, LD, MO, P, PH, PRE, S, Z), 313a (PRE); Agtertuin, *Schlechter* 10866 (B, BM, BOL, BR, G, K, L, MO, P, PH, PRE, S, Z); top of Biedouw Pass, SE slopes, *Mauve & Oliver* 82 (K, MO, PRE, S); *Goldblatt* 2540 (K, MO, NBG, S, US, WAG); Cedarberg Forest Reserve, Langrug, 1,000 ft. (AC), *Viviers* 584 (MO); Matjesrivier, Cedarberg (AD), *Wagner* 214 (NBG).

SPECIES INCOMPLETELY UNDERSTOOD

The following represent apparently undescribed species, but the material available is too fragmentary and incompletely known to form the basis for the description of a new species.

1. *Geissorhiza* sp. 1 (*Rogers* 28746, Z).

A collection of only two plants made by F. A. Rogers at Ceres clearly represents a species not included in this revision. The corm appears to have imbricate tunics which places the species in subgenus *Geissorhiza*. Other significant characteristics include two basal, and a third cauline and partly sheathing, narrow and linear, foliage leaves that have thickened margins and midrib and thus are narrowly 2-grooved on each surface; a puberulent, unbranched stem; an apparently membranous bract in the upper part of the stem; and spikes of 2 long-tubed flowers. The plants are 15–20 mm high and very slender, the leaves about 1 mm wide and half as long as the stem. The flowers appear to be salver shaped, with a tube 9–12 mm long and horizontally extended tepals ca. 16 mm long. The stamens are unequal, the two longer with filaments 5 mm long and a shorter one with a filament 2.5 mm long. The style is of the *Geissorhiza* type and reaches to about the apex of the anthers and has 3 spreading branches.

The morphology of the leaves and stem, as well as the flower with unequal stamens all sug-

gest that this species is correctly assigned to subgenus *Geissorhiza*, in which unequal stamens are common and pubescent stems not unusual. The affinities of the species are most likely with section *Monticola*, most species of which have unequal stamens, but usually branched stems. However, stem pubescence is unknown in the section. Further material is needed before the species can be described and its relationships more adequately assessed. Locality information is unfortunately limited to Ceres and the altitude 1,400 ft. Ceres may represent the town itself, the immediate surroundings or the district that extends well to the north. The altitude suggests that the species grows on lower to middle mountain slopes.

2. *Geissorhiza* sp. 2 (Stokoe s.n., SAM 65812).

A collection of a small species, made in December 1952 by T. P. Stokoe at Oudebosch in the Palmiet River Mountains, appears to represent either an undescribed species or a very aberrant form of a known one. The plants are 10–15 cm high, have linear, plane leaves and smooth, simple or 1-branched stems with solitary flowered spikes. The corms are small and apparently have soft-textured tunics that do not accumulate to any degree, and it is not possible to determine whether the tunics are concentric or imbricate. Accordingly, the species cannot be assigned to subgenus with certainty. The overall appearance of the plants and the soft plane leaves, however, suggests that the species belongs in section and subgenus *Weihea*. The branching pattern is unusual. The branches are almost equal in length and so appear dichotomous. This type of branching is known in *Geissorhiza* only in *G. geminata*, also section *Weihea* and it is to this species that *G. sp. 2* is assumed to be allied if not simply a depauperate form of *G. geminata*. More material of the species is needed before a final decision can be taken on the status of this collection.

EXCLUDED SPECIES

- Geissorhiza abyssinica* R. Br. ex A. Richard, Tent. Fl. Abyss. 308. 1850.
 = *Lapeirousia abyssinica* (R. Br. ex A. Richard) Baker (Baker, 1898; Cufodontis, 1972).
Geissorhiza albens E. Mey. in Drège, Zwei Pflanzengeogr. Dokum. 187. 1843, nom. nud.
 = *Gladiolus debilis* Ker (Lewis et al., 1972).

- Geissorhiza alpina* Hook. f., J. Linn. Soc., Bot. 7: 233. 1864.
 = *Hesperantha petitiana* (A. Richard) Baker.
Geissorhiza ambongensis H. Perrier, Notul. Syst. (Paris) 8: 130. 1939.
 = ? *Tritonia* sp. (Goldblatt, 1982b).
Geissorhiza anemonaeflora (Jacq.) Klatt, Linnaea 34: 657. 1866. *Ixia anemonaeflora* Jacq. Icon. Pl. Rar. 2: tab. 273. 1793.
 = *Ixia campanulata* Houtt. fide Lewis (1962).
Geissorhiza bojeri Baker, J. Bot. 14: 239. 1876.
 = *Gladiolus bojeri* (Baker) Goldbl. (Goldblatt, 1982b).
Geissorhiza briartii Wildem. & Durand, Bull. Soc. Roy. Bot. Belgique 39: 105. 1900.
 = *Lapeirousia erythrantha* (Klotzsch ex Klatt) Baker var. *briartii* (Wildem. & Durand) Geerinck, Lisowski, Malaisse & Symoens (Geerinck et al., 1972).
Geissorhiza erecta Baker, J. Bot. n.s. 5: 238. 1876.
 = *Hesperantha erecta* (Baker) Benth. ex Baker (Goldblatt, 1984).
Geissorhiza gracilis Baker, Handb. Irid. 155. 1892.
 = *Gladiolus parvulus* Schltr. (Lewis et al., 1972).
Geissorhiza grandis Hook. f., Bot. Mag. 96: tab. 5877. 1870.
 = *Gladiolus floribundus* Jacq. subsp. *milleri* (Ker) Oberm. (Lewis et al., 1972).
Geissorhiza latifolia (de la Roche) Baker, J. Linn. Soc., Bot. 16: 94. 1878.
 = *Ixia latifolia* de la Roche (Lewis, 1962; Goldblatt & Barnard, 1970).
Geissorhiza longituba Klatt, Linnaea 35: 383. 1867–1868.
 = *Hesperantha longituba* (Klatt) Baker (Goldblatt, 1984).
Geissorhiza lutea Ecklon, Topogr. Verz. Pflanzensamml. Ecklon 21. 1827, nom. nud.
 = *Hesperantha falcata* (L. f.) Ker (Goldblatt, 1984) (syn. *Hesperantha lutea* Ecklon ex Baker).
Geissorhiza macra Baker, Bull. Herb. Boissier, Ser. 2, 4: 1004. 1904. TYPE: South Africa. Transvaal: Mt. Malchachi, *Jacottet s.n.* (G, not seen; GH, photo).
 = *Hesperantha* sp., the fairly large flowers are borne singly on the stems.
Geissorhiza minima Baker, J. Bot. n.s. 5: 239. 1876.
 = *Hesperantha minima* (Baker) Foster (Foster, 1948; Goldblatt, 1984).
Geissorhiza patersoniae L. Bolus, Ann. Bolus Herb. 1: 132. 1915.

- = *Gladiolus stellatus* Lewis (Lewis, 1966; Lewis et al., 1972).
- Geissorhiza pauciflora* Baker, Bull. Herb. Boissier, Ser. 2, 10: 1004. 1904.
- = *Hesperantha falcata* (L. f.) Ker (Goldblatt, 1984).
- Geissorhiza quadrangula* (de la Roche) Ker, Irid. Gen. 88. 1827. *Ixia quadrangula* de la Roche, Descr. Pl. Aliq. Nov. 16. 1766.
- = *Gladiolus quadrangulus* (de la Roche) Barnard (Goldblatt & Barnard, 1970).
- Geissorhiza recurvifolia* (Poirot) Klatt sensu Klatt, Linnaea 34: 655. 1866. *Ixia recurvifolia* [sic] Poirot in Lam., Encycl. Suppl. 3(1): 201. 1813, nom. var. vel. nom. superfl. pro *Ixia recurva* Red., Liliac. 5(42): tab. 251, f. 2. 1809.
- = *Romulea* cf. *flava* (Lam.) De Vos (De Vos, 1972).
- Geissorhiza schlechteri* Baker, Bull. Herb. Boissier, Ser. 2, 9: 43. 1901.
- = *Hesperantha schlechteri* (Baker) Foster (Foster, 1936).
- Geissorhiza sublutea* (Lam.) Ker, Ann. Bot. (König & Sims) 1: 224. 1804. *Ixia sublutea* Lam., Encycl. 3: 335. 1789.
- = *Romulea triflora* (Burm. f.) N. E. Brown (De Vos, 1972).
- Geissorhiza vaginata* Sweet, Brit. Flow. Gard., Ser. 1, tab. 138. 1826.
- = *Hesperantha vaginata* (Sweet) Goldbl. (Goldblatt & Barnard, 1970; Goldblatt, 1984).
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